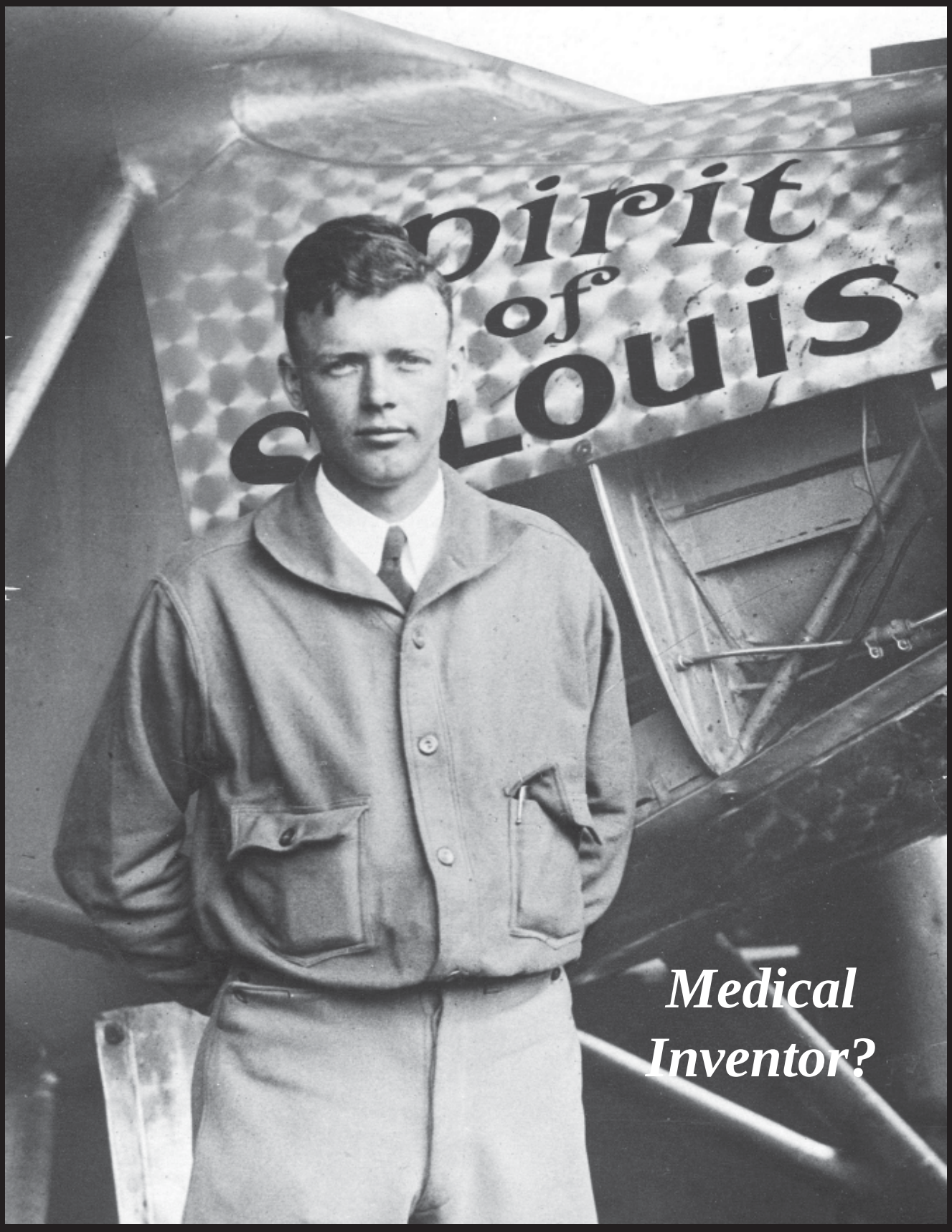
NAVY MEDICINE

November-December 2003



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COVER: Charles A. Lindbergh, perhaps the most famous aviator of the last century, is best known for the first solo crossing of the Atlantic. Less known are his contributions as a biomedical engineer and researcher. Story on page 18. Photo courtesy Minnesota Historical Society.

Navy Medicine R & D Laboratories

Supporting Global SARS Surveillance Efforts

Navy medicine's overseas laboratories are supporting efforts to track and prevent the spread of severe acute respiratory syndrome (SARS). The labs in Indonesia, Egypt, and Peru, along with their Army counterparts in Kenya and Thailand, represent a unique network of research facilities studying infectious disease threats to deployed personnel. The labs are part of the DOD Global Emerging Infections Surveillance and Response System (DOD-GEIS).

In just 4 months SARS became a household word around the world. On 12 March 2003, the World Health Organization (WHO) issued a global alert about an outbreak of a pneumonia-like illness in China and just beginning in Hong Kong. On 14 March, the Centers for Disease Control and Prevention (CDC) set up the SARS emergency operations center (EOC) in Atlanta. CDR Randall C. Culpepper, MC (FS), Director of the DOD GEIS Overseas Operations was invited to be the first DOD liaison officer to the SARS EOC.

Culpepper said, "The CDC asked DOD to participate because it was important for the global community to work together in real-time, to track the spread of this disease and institute protective measures to prevent new cases from occurring. We knew what the CDC was discovering on a daily, sometimes hourly basis, and we could share that information with all the overseas laboratories. The labs are a great conduit of information from forwarding specimens to the CDC to distributing test results and guidance to host country clinicians."

According to Culpepper, DOD was very proactive in the early stages of the SARS epidemic by bringing the overseas assets and the military public health community to the table and discussing openly the threat of this virus to force health protection. Of particular concern were Operation Iraqi Freedom and joint exercises like Cobra Gold in Thailand, JTF-FA Operations in Indochina, and the training exercises in the Philippines.

Highlighting one success story, the Navy lab in Southeast Asia was involved in the earliest stages of the outbreak. In March, the CDC asked for assistance in getting specimens to Atlanta. Researchers from the Naval Medical Research Unit No. 2 (NAMRU-2) in Jakarta were already working with the Ministry of Health in Vietnam and the commanding officer sent staff members to the Pasteur Institute and affiliated hospitals in Ho Chi Minh City to facilitate the collecting and shipping of specimens.

CAPT Andrew Corwin, Head of the Emerging Diseases Program at NAMRU-2 said, "The lab, as a WHO Collaborating Center for Emerging and Re-emerging Diseases, has a uniquely focused strategy on developing outbreak surveillance and response activities in the region. That includes developing laboratory diagnostic capabilities to identify causes of epidemics, supporting outbreak investigations, and conducting outbreak response training workshops."

The Jakarta lab is assisting the local pubic health communities in several affected Asian countries. Researchers are working with the ministries of health in Lao PDR (Lao People's Democratic Republic) and Cambodia. Representatives from those two countries and Vietnam, along with host country public health professionals are attending NAMRU-2's training workshops. Navy researchers are partnering with the Indonesian National SARS Task Force and 34 hospitals located throughout the archipelago to ensure specimens are safely collected, packaged, and sent to CDC Atlanta for analysis.

Like NAMRU-2, the Naval Medical Research Unit No. 3 in Egypt and the Naval Medical Research Center Detachment in Peru are working closely with the ministries of health in their host countries to conduct surveillance efforts, detect new cases, and institute the prevention measures recommended by the CDC. ❑

—Story by Doris M. Ryan, Public Affairs Specialist, Bureau of Medicine and Surgery (M0P1), Washington, DC.

Antimalarial Drug Resistance Surveillance in South America

A Joint U.S. Navy and CDC Initiative

CAPT Trenton K. Ruebush, II, U.S. Public Health Service
CAPT James P. Burans, MSC, USN

As recently as 1995, a look at a map of national malaria treatment policies in South America would reveal little or no rhyme or reason to the choice of drugs for the treatment of malaria in different countries in the region. First-line drugs for the treatment of uncomplicated *Plasmodium falciparum* infections ranged from chloroquine (CQ) and sulfadoxine-pyrimethamine (SP) on the Pacific Coast of Peru and Ecuador to combinations of quinine plus tetracycline in Colombia to mefloquine in the Amazon region of Brazil and halofantrine in French Guiana. In many of these countries national malaria treatment policies were based largely on clinical experience suggesting that a given antimalarial drug was or was not efficacious, rather than on drug resistance testing. Even if such information was available, the variety of different *in vivo* and *in vitro* approaches used to assess the level of resistance has made it difficult to compare the results from one trial to another or from one country to the next.

It was in this setting that the Global Emerging Infections Surveillance and Response System (GEIS) was initiated in 1999. This program is a presidentially-mandated, 5-year initiative to support global surveillance, training, research, and response to emerging infectious diseases of importance not only in the U.S. military, but also of general public health importance. Within DOD, the existing network of OCONUS medical research units have a critical and unique role to play as models for regional infectious disease surveillance and capacity building. At the Naval Medical Research Center Detachment (NMRCD) in Lima, Peru, one of the principal components of the GEIS program is surveillance for antimalarial drug-resistance, a major public health threat in South America, particularly in the Amazon Basin.

Between 1990 and 1998, Peru experienced a major resurgence of malaria in its Amazon region, believed to be due primarily to the invasion of the area by an extremely efficient malaria vector, *Anopheles darlingi*. In 1997-99, malaria transmission on the northern coast of the country increased dramatically as a result of flooding following heavy rains associated with the El Niño phenomenon. At that time, CQ was the first-line drug for the treatment of uncomplicated *P. falciparum* malaria on the northern coast, while in the Amazon region, either CQ, SP or quinine plus tetracycline were recommended, depending largely on local clinical experience.

Early in 1997, Dr. Trenton Ruebush was invited by the Peruvian (Ministry of Health (MOH) and United

States Agency for International Development (USAID)-Peru, as part of a team of epidemiologists and entomologists from the Centers for Disease Control and Prevention (CDC) in Atlanta, to review the status of the malaria control program in the Amazon region. Since there were no recent data on the efficacy of the drugs being used for the treatment of *P. falciparum* infections and reports from physicians suggested that CQ, and perhaps SP as well, were no longer efficacious, one of our principal recommendations was to conduct *in vivo* efficacy testing for first-line and potential second-line drugs as quickly as possible.

The following transmission season, a team from CDC conducted training of Peruvian MOH staff and, with the assistance of NMRCD in Lima, carried out an *in vivo* trial of the efficacy of CQ and SP for the treatment of uncomplicated *P. falciparum* malaria in Iquitos, the major city in the Peruvian Amazon region. This trial demonstrated >50 percent resistance to both drugs.

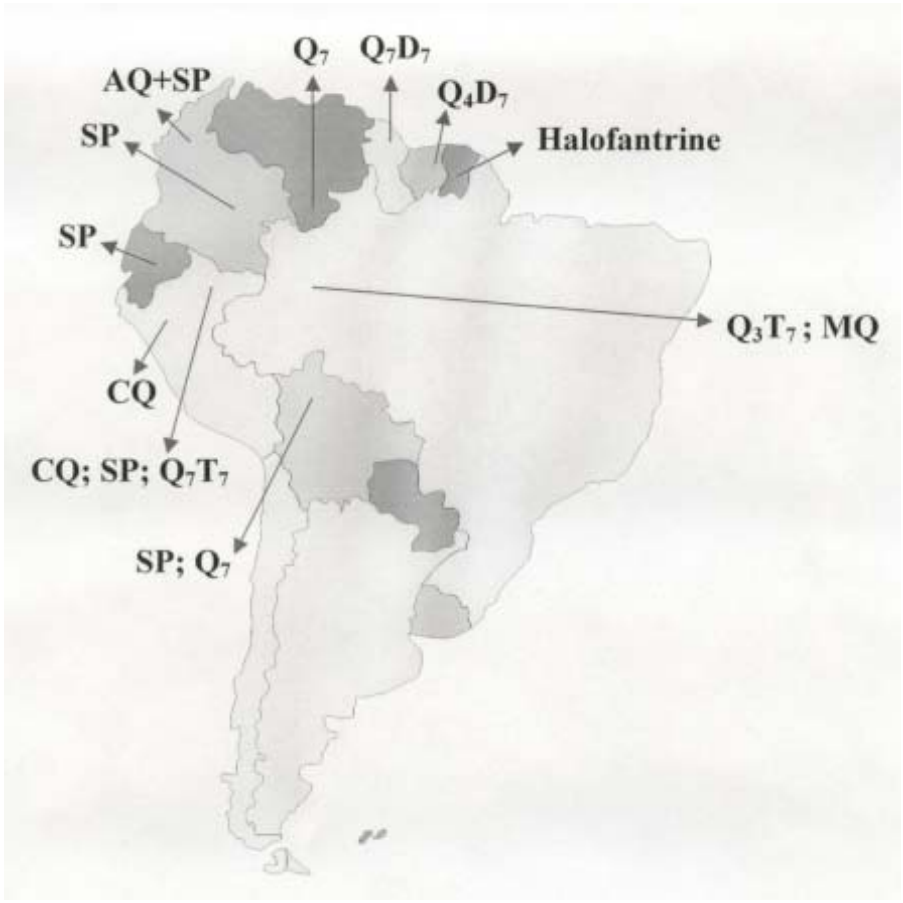
During the 1999 malaria transmission season, CDC collaborated with previously trained MOH staff in an evaluation of the efficacy of CQ and SP at three sites on the north coast of Peru. This trial showed resistance levels of >50 percent to CQ but of <5 percent to SP at all three sites. At about the same time, NMRCD was conducting an SP efficacy trial at a site near the Colombian border in the northeastern Peruvian Amazon basin, which confirmed the high rates of SP resistance in this region.

Since the NMRCD physician who was supervising GEIS antimalarial drug resistance surveillance in Peru was scheduled to return to the U.S. in late 1999, Dr. Ruebush was approached with the proposal of being seconded to NMRCD for a 2-3 year tour to continue the GEIS antimalarial drug resistance activities. An agreement was reached between the Navy and CDC on the terms of his assignment and, in August, he transferred to Lima and joined the NMRCD staff.

Later that same month, a national-level meeting was held in Lima, at which the findings of the drug efficacy studies conducted during the 2 previous years were reviewed and a consensus was reached about a proposed change in national malaria treatment policy based on those findings. It was recommended that the first-line therapy for uncomplicated *P. falciparum* infections in the region be changed to combination therapy with mefloquine plus artesunate in the Peruvian Amazon and to SP plus artesunate on the north coast of Peru. This proposed use of combination antimalarial therapy was in line with the World Health Organization's (WHO) recent recommendation that national malaria control programs begin to change from monotherapy to combination therapy to slow the development of antimalarial drug resistance. However, since neither mefloquine nor artesunate had ever been used previously in Peru and experience with the combination of SP plus artesunate was limited to a single field trial in West Africa, it was recommended that implementation of the new combination therapy policy be delayed until trials could be carried out to confirm their safety and efficacy in Peru. In the interim, the National Malaria Control Program decided to change to SP as the first-line drug on the north coast and to quinine plus tetracycline throughout the Amazon region.

During 2000, with GEIS and USAID funding, MOH and NMRCD staff collaborated on a trial comparing mefloquine monotherapy with the combination of mefloquine plus artesunate in the city of Iquitos in the Peruvian Amazon. No evidence of resistance to either regimen was identified. A similar trial comparing SP monotherapy with SP plus artesunate combination therapy was conducted on the north coast. This study showed low levels of resistance to SP alone but none to the combination of SP plus artesunate. Following completion of these trials, a second national meeting was held to review these data and ratify the earlier recommendation that Peru implement combination therapy on the north coast and the Amazon region. Supplies of mefloquine and artesunate have already been purchased by the National Malaria Control Program and the new combination therapies are expected to be implemented later this year.

As a direct result of the very effective collaboration between the Peruvian MOH, NMRCD through its GEIS program, USAID, and CDC during the last 4 years, Peru now has the most complete and up-to-date information on the status of antimalarial drug resistance within its borders as compared to any other country in the Americas. This information has allowed the Peruvian National Malaria Control Program to move much more quickly than in any neighboring country. With the changes in national malaria treatment policy that are due to take effect later this year, Peru will become the first country in the Americas to use combination antimalarial therapy with SP plus artesunate and the first country in the world to use two different combination therapies in different regions of the country. Plans are now being made to set up ongoing surveillance for antimalarial drug resistance at sentinel sites around the country.



First-line Antimalarial Drug Therapy for *Plasmodium falciparum in* South America, 1995.

Legend for figure:
AQ=amodiaquine
CQ=chloroquine
D=doxycycline
MQ=mefloquine
Q=quinine
SP=sulfadoxine-pyrimethamine
T=tetracycline

Since one of the primary goals of the GEIS program is to build capacity for infectious disease surveillance throughout the region, we took advantage of the two large combination drug trials conducted in Peru during 2000 to offer hands-on training to physicians and laboratory staff from other national malaria control programs in the region in *in vivo* drug efficacy testing. With financial support from the Pan American Health Organization and USAID-Bolivia, training was provided to Bolivian and Surinamese staff. Armed with this first-hand experience and with technical assistance from Peruvian MOH and NMRCD staff, these individuals are now overseeing drug efficacy trials in their own countries, which are expected to lead to modifications in their national malaria treatment policies. The Bolivian studies are being funded by USAID-Bolivia, while the studies in Suriname are being funded by NMRCD through the GEIS program. Later this year, Peruvian MOH and NMRCD staff are planning to assist the Ecuador National Malaria Control Program in implementing studies at two sites along their Pacific Coast that will be jointly funded by the Pan American Health Organization and GEIS.

Although over time the Peruvian MOH would undoubtedly have carried out many of these studies and made many of the same malaria treatment policy decisions, the GEIS initiative has clearly provided the impetus to move much more quickly and in a much more rational fashion towards mapping the geographic distribution of antimalarial drug resistance within Peru and updating malaria treatment policy and establishing ongoing surveillance of drug resistance in the future. The GEIS program has also helped to integrate the various groups interested in antimalarial drug resistance surveillance in Peru, as well as in other countries in the region. As a result of the work that has been carried out in Peru over the last 4 to 5 years, Peru and the Peruvian MOH are increasingly being viewed by WHO as models within South America for countries that want to assess the status of drug resistance and consider changes in their malaria treatment policies. ❑

Dr. Ruebush is with the U.S. Public Health Service, Lima, Peru

Dr. Burans is assigned to U.S. NMRCD, Unit 3800, Lima, Peru.

The Surgeon General's Exercise in Operational Leadership Goes to Sea

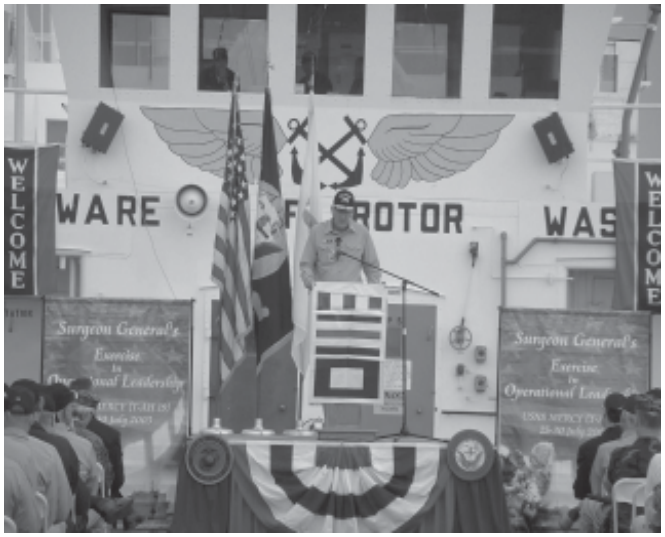
Photos by LT Melody S. Peale, MSC

VADM Cowan arrives to check in aboard USNS *Mercy*, July 2003.

The venue for this year's Surgeon General's Exercise in Operational Leadership (SGEOL) was USNS *Mercy* (T-AH 20) as the hospital ship made its way from San Diego to Seattle. The theme of the exercise was "Underway, Shift Colors," which emphasized Navy medicine's journey into the future and its commitment to success in meeting the new challenges. Besides *Mercy*'s regular staff and crew, on board were 300 members of Navy medicine's senior leadership. In fact, the voyage in late July set a new Navy record. At no time since the Japanese surrender ceremony in 1945, when Allied brass crammed the deck of USS *Missouri* (BB-63) to witness the end of World War II, have more senior officers been aboard a U.S. Navy vessel. And, in this case, *Mercy* was not at anchor but underway! Because *Mercy* was already scheduled for an exercise with Canadian forces in Vancouver, British Columbia, Surgeon General of the Navy VADM Mike Cowan decided to take advantage of a unique opportunity to hitch a ride on the ship with his senior leadership.

Why the radical departure from the traditional? Why not hold the SG's annual leadership meeting in a Washington hotel as it has been for many years? Why not stick to the standard format of past conferences in which BUMED and headquarters leadership presented current information, several interest groups interacted, and participants provided their input?

Very simply, these were mainly didactic conferences, no different from any other that might be held for corporate leadership. "If we are to become an information guided organization," VADM Cowan points out, "then we have to bring as many people—as much leadership as possible—into that process. The idea is to go beyond merely letting them see sausage being made in Washington. They must be a part of the deliberations. We have to use the accumulated wisdom of our leadership to build our annual plan for the organization. Why let the guys in Washington do it and tell the field what to do when the field ought to be telling the guys in Washington what they ought to be doing." The idea of using *Mercy*, VADM Cowan explains, "was to move us away from the diversions that come with getting together in a city hotel. So, I decided to hijack the leaders, take them away from these diversions, and ask them to do the unprecedented act of being a 300-person executive steering committee to share



VADM Cowan opens the Surgeon General's Exercise in Operational Leadership conference on *Mercy*'s helo deck.

our vision. I wanted them to achieve alignment with our strategic plan and then build an annual plan so that when we walked off the ship, we knew what our annual plan would be, or at least would have made major progress toward that plan. In addition, we would have something tangible, something we would have already agreed to do and could execute immediately."

Even before the lines were cast off at the Coronado pier, the participants began addressing five principal areas deemed important for the future of Navy medicine—Readiness, Optimization, Integration, Alignment, and Covenant Leadership. As they developed action plans, they also looked at significant external influences on Navy medicine's future. The Surgeon General recognized that these influences represent opportunities for Navy medicine to improve its mission support and services. They included Sea Power 21, Marine Corps Strategy 21, the Global War on Terror, and BRAC 2005.

As *Mercy* steamed north toward Seattle, the conference's participants deliberated during many formal sessions. With after-hours entertainment aboard the ship somewhat limited, casual discussion about the state of Navy medicine often continued during meals and into the night. Many old friendships were renewed and new professional relationships began.

There were other tangible benefits to the cruise as well. Certainly, a few of the participants who had served at naval hospitals or with the Marines—senior petty officers, commanders, captains, rear admirals, and senior civilians—had never really been to sea before—and so this was a new experience. Admittedly, a clean modern hospital ship is not a destroyer, submarine, carrier, or tender. Nevertheless, for a brief few days, these personnel slept in Sailor's berthing, 120 to a space. Commanders, captains, and admirals shared staterooms, lined up for morning showers, stood in chow lines, conducted lifeboat and man-overboard drills, and were subjected to the lack of privacy and ever-present ship noise Sailors take for granted. For an instant, at least, they got a hint of what a mariner's life might be like.

Even before Mercy entered Puget Sound, the SGEOL had accomplished some of its goals. In addition to identifying multiple issues that required further action, Navy medicine's leaders had achieved what VADM Cowan called "quick, splashy, victories," ideas that could be implemented by the field immediately. These were recommendations not requiring more resources—initiatives that didn't require headquarters permission to enact. Here is a sample:

- Give operational training top priority at MTFs
- Create a culture of wellness and fitness—lead by example
- Expand partnerships with local, state, and federal agencies
- Position resources for medical care where the customers are
- Combine functions where cost-effective
- Optimize reserve medical personnel
- Align NAVMED transformation to OPNAV
- Reward exceptional customer service productivity and quality of care/service
- Update THCSRR
- Institute officer FMF warfare device

"The next trick," says VADM Cowan, "is follow-through. I think we have clear guidance, we have a commonality of vision about what we are to do, and we have identified things that are not only do-able but important to be done. I believe we will see the kind of buy-in that allows us to execute this plan and make major improvements in naval medicine."

So, with a successful SGEOL conference at sea under our collective belts, what's in store for Navy medicine's senior leadership next year? Another voyage perhaps? Not likely, according to VADM Cowan. "This was a one-trick pony. We accomplished what we set out to. I see no advantage in repeating the exercise." Might Navy medicine's leaders find themselves deliberating at a Himalayan monastery next summer? Stay tuned. ❑

—Story by Jan Kenneth Herman, Historian, Bureau of Medicine and Surgery (M09H), Washington, DC.

The Story Behind the Picture

HM1(FMF) Richard W. Barnett, USN

U.S. Marine Corps photo

One of the most noted photographs to come out of the Iraq war is one of a hospital corpsman tenderly holding an Iraqi child. During the Surgeon General's recent Exercise in Operational Leadership held aboard USNS Mercy, *HM1 Barnett told the real story behind the picture.*

I understand my presence here today is due to the notoriety attained by a certain photo. I suppose it just goes to show you what a good publicist can do for you.

If you will grant me a few minutes I would like to talk about what we experienced in Iraq and try to do service to the people I've worked with, passing on a few of the things we discussed following the war. This opportunity is a privilege I thank you for.

Several of us were augmented from Navy Ambulatory Care Clinic (NACC) Port Hueneme, CA, and attached to the 3rd Battalion of the 1st Marines (3/1), "The Thundering Third."

The 3/1 is an incredible unit, decorated in battle at places with names I am sure you will recognize: Guadalcanal, New Guinea, Okinawa, North China, Inchon, Chosin Reservoir, Da Nang, Thang Bing, Kuwait, Somalia, and, most recently, in Iraq, so you can see we had a lot to live up to. They had just finished a deployment in support of Operation Enduring Freedom in the Middle East, where they had again come under fire, when they were given orders to re-deploy, this time to Kuwait in preparation for the possible invasion of Iraq. They had barely been home 30 days after their 6-month deployment when they found themselves on *Bonhomme Richard* and *Boxer* crossing the Pacific again. We joined this proud unit in LSA1, "Camp Coyote," where we acclimated ourselves and prepared for what was to come.

Most of the comments heard around camp revolved around getting started, so we could get this done and go home again. Perhaps we would not have been quite as enthusiastic in our wishes if we had known that 2 days later, at a pause, as we approached the "line of departure" the war would start for us with a cry of "Scuds inbound!"

We dove into what the Marines call "hasty fighting holes" that we had spent a ridiculous amount of time digging for our beds. I had a hard time explaining later to my civilian friends that I had to **dig** my bed every night. For those of you that haven't had the pleasure, a hasty fighting hole is about 6 feet long, 3 feet wide, and 2 feet deep, with a berm. They suddenly felt much too shallow as we watched the sky.

After an eternity the all clear sounded and we were told to fill in our holes and mount up, we were moving out.

Not 15 minutes later the cry of "scuds inbound" came again. Most of us hadn't gotten around to filling in the holes that had been our security blanket a few minutes before and we threw ourselves back in with enthusiasm. When I started scanning the sky I noticed one of my corpsmen, HM3 Desousa, standing on the mound of dirt that used to be his hole with a look of complete panic on his face. His shovel was flying up and down with a stream of gas mask-muffled curses coming from his mouth. I wasn't the only person to notice, because three other corpsmen and one other Marine joined me at his side and a hole that had taken Desousa the better part of an hour to complete was re-dug within 2 minutes. There was so much dirt flying it must have looked like badgers on speed.

When I flopped into my hole again I began to think about what had just happened. Those other three corpsmen and that Marine didn't have the responsibility for Desousa that I had, but they were there by our side, without hesitation or thought for their own personal safety. I was going to find over the next month that the casual selflessness and care for your comrades that I had just witnessed wasn't the exception with these people. It was the rule. It was at that moment that I understood. If it was possible that I get home from this war, my shipmates would make sure it would happen. I could put my life in their hands with confidence and concentrate on the job I had to do. Every Marine, every corpsman in my unit can tell you at least one story, and most more than one, about how another Marine or Sailor saved them, fed them, kept them healthy and alive, shared the last of their food, spelled them on a watch in the middle of the night. If one of these men were asked he might admit to doing the same for someone else, but they wouldn't volunteer the information; to them it was just something they did.

Other than overt military action, most of the Iraqis seem pleased when we entered cities and towns, at least those that we saw during the day. The tone changed as night began to fall. There was a real Jekyll and Hyde feeling to the whole country. Groups that held long-standing feuds with each other suddenly had no one to stop them from taking their arguments as far as they wanted to, and most of them ended up in the streets. Gunfire filled entire neighborhoods every night. Some of them used the darkness and violence as an opportunity to hide as they fired on our positions. Occasionally there were places in Iraq where we couldn't dig in. One was a landfill with trash and other less nice things laying about everywhere. The few Marines that started to dig in soon thought better of it. What they found just below the surface you don't want to know about. Anyway, we were bunked down for the night, watching the occasional tracer go overhead when all of a sudden the fire passing over us became a bit more intense, then a lot more intense, then became aimed fire on our position. There we were lying in our sleeping bags as tracers skipped along the ground on both sides of us. Ever try to move fast in a sleeping bag?

The underside of a Humvee is a cozy place sometimes. At least when the rain is metallic. It was surprising how many people could fit under there.

While we were in Baghdad certain segments of the Iraqi populace continued to take objection to our presence. Even when the gross organized resistance was eliminated it continued on a smaller scale. Our squad teams became very proficient at finding weapons caches and setting up ambushes. The snipers then had a field day. They would often catch the combatants exiting their stash and advanc-

ing on our positions long before they got into effective range.

The Iraqis tired of this and started backing off a few blocks and spraying unaimed fire into the air in our direction. Every night you could hear the bullets rattling off the buildings around us and occasionally actually falling on the compound itself. They were lucky if they found their target, but at least half a dozen of us got hit and I am here to tell you, from personal experience, that even getting hit in the butt hurts like the devil; and that carrying a pair of surgical scissors in your back pocket may indeed save your ass—literally.

After I received your invitation I spent a great deal of time puzzling about what you would want to hear, I even wondered if there was anything you needed to hear. This is a once in a lifetime opportunity, and I don't want to waste it. I asked as many people as I could, if they were seated here today, what they would want to hear, what they were curious or concerned about, and I asked my shipmates if there was anything they wanted me to say. I received the same bit of advice, repeatedly. Tell them what we saw and felt, what we learned. So here it is.

When the war first started many of us wondered, like many of the press, if the U.S. was doing the right thing, or if there wasn't another way, if war couldn't be avoided somehow. We wanted to be with our loved ones.

Personally, I no longer have any doubts, I know we were doing the right thing and I know why I was there.

I was there for my wife and my niece and her husband, for my brothers and their families. I was there because, as much as I missed my family, making the world safe for them took a higher priority. Once the war started we saw what had happened to the people of Iraq, and we heard about it from their own mouths. How women and girls were casually raped, by any man with authority, without consequence. How people were tortured and killed randomly just to keep the level of fear high. While that sort of evil exists in the world my family is not safe. Any regime that will do what his did will stop at nothing. Why should they if there is no one willing to say no, to stand there and say this will not be tolerated? Should we have expected him to magically learn restraint, to have a sudden attack of decency or even common sense? The man used Himmler and Stalin as his role models. He and his regime were an evil that needed to be blotted from the face of the earth and I am proud to have been part of it, but the cost of having the courage of our convictions was so very high. So many lives were lost or destroyed. Men, women, and children died in front of us, torn apart by the violence of war, despite the best we could do, and those memories are something that we will carry with us forever—as we should.

The price paid for freedom should never be trivialized, never be forgotten or reduced to numbers. If it were possible, every face, every name should be remembered. The course of nations changed at the price of their lives, whether they be American, British, or Iraqi.

As physically devastated as Iraq now is, it breathes a sigh of relief due to their sacrifices and has a chance to shape itself anew. No one knows what will come next, but our actions gave the Iraqis a chance and eliminated a threat to those we love.

Now that the war is over I suppose it is time for questions and after action critiques. My shipmates and I would like to start with the one question I hope we can ask, and eventually answer: What are we—the medical community—preparing for as we train?

The shooters, the Marine Corps ground forces, and the pilots, the tanks, and the shipboard crews, train for war every day. It is their primary focus. What is ours?

The shooters practice different scenarios and problem solving constantly. The Marines in particular have adopted the philosophy of "adapt and overcome," realizing, through experience, what they face may very well not be what they trained for. They are constantly training flexibility into their people. Are we?

I have watched countless new doctors come into a battalion surgeon or flight surgeon job, and have to relearn that job from scratch. That they do is miraculous and the Marines and Sailors tended to under their care will attest to it.

Why should these doctors, and the corpsmen that work with them have to reinvent the wheel? How can we train in a way that will allow us to pass on the lessons we learn more efficiently, be more flexible, and better prepared and do this without compromising the services already in place?

A pilot I know just came back from a 3-day simulator where the instructors tried to crash his airplane in every way they could. They made him figure out how to adapt to different emergencies again and again. How can we adopt this philosophy for ourselves? And how can we do this without spending millions of dollars on simulators? How can we create this type of interactive training and problem solving tool with the assets already at our disposal?

While in Iraq we spent a month in our Mission-Oriented Protective Posture (MOPP) suits, but many of us

had little or no chance to really train in them prior to that. We walked through it in CONUS of course, and again in Kuwait; everyone did, but how many of us have treated a patient in a chemical, biological, radiation (CBR) environment? … a real one. Do we know what we have discussed and trained for will work? Have we taken it to the gas chamber and tried it on the battalion and squadron levels?

Working in a gas-mask is claustrophobic; it takes getting used to. Just breathing takes more work than you anticipate. You can feel short of breath while just sitting. You add real exertion to that and the desire to rip the damn thing off is hard to fight.

The Army gas alarms went off constantly while we were in Kuwait, so we got plenty of practice donning and clearing those masks, and it was the first time in my career that I had to wear it for a truly extended time.

We were told that there were no drills in theater so we took those alarms seriously. As far as we knew, anyone of those could have been a deadly attack. Still it took time and experience to develop good habits with that equipment.

Here is the thing. We, the medical community at the battalion level, historically, have gotten in the habit of preparing for deployment, not for war. The Marines train for war; they train to fight. We provide corpsmen support when they go out and train, but we rarely, if ever, spend a great deal of time gaming out our own responsibilities on the squad or company level.

Medevacs are an example of someplace we were not very flexible at the battalion level. If the threat had dynamically changed we had not trained in a way that would have left us ready to respond and adapt. We dodged a bullet this time; we were lucky as hell that the fight was as easy as it was, and that the Iraqis hadn't seen and recognized our real vulnerability—our LOG trains.

We found out through our difficulties in resupply how vulnerable they were. One of our strengths has always been that we try to learn from our mistakes, hence the after action reports. Units operated in theater for 90 days with the same AMAL that they came into theater with—an already thin 30-day supply. We ran out of medications and bandages, an endless list of things. One of my friends nicknamed the march to Baghdad "Operation incredibly long supply line." Our warfighters had moved faster than the LOG train could support.

Our primary route of evacuation was helicopter. We learned the hard way in Somalia what a rocket propelled grenade (RPG) can do to a helicopter that has to hover, i.e., a medevac. Every combat casualty we evacuated went by helicopter, and we were so far forward there really was no other way to get them out in any sort of timely manner. There was a real fear that we would be caught forward with an overwhelming number of casualties and the Iraqis would start targeting helicopters as they came in for medevac.

We tried to make the landing zones (LZs) as safe as we could, but where, for instance, in Al-Nazaria would that be? Outside the city? Okay, how do we get them there? Where do these assets come from? How about their security? In truth these are not difficult questions to answer, but how many battalions went out and dealt with this, or things like this before they faced them for real on the battlefield?

What about environmental challenges that deny a medevac for prolonged periods? Take for instance… wind. The wind in that part of the world was something to experience. In the desert there was nothing to break it up, or even slow it down, so when it built it stayed intense for a while.

I remember one evening, while still in Kuwait, that introduced us to what we would be facing. The wind was blowing so hard that every tent was jumping up and down like a pogo stick. Now you have to imagine this. The tents are around 100 feet long with 8-inch diameter, 25-foot high steel poles every 15 feet or so. These poles were jumping 2 feet or more into the air as the wind tried to pick up the whole 100-foot tent. Even with all the flaps sealed the dust was so thick in the air that you could barely see 5 to 6 feet in front of you.

As for movement. Forget about it.

We faced the same conditions repeatedly during the march and the assault. Sealed tightly in your bivvy or your vehicle, you just hoped you didn't find yourself in Oz when the storm broke.

We have to look at the way we train closely, at what is really important to us, asking repeatedly what our primary mission is, because it's always changing. And then be prepared to act on the answers we come up with, in a timely fashion.

Do we have that kind of responsiveness built into our systems right now? We have never needed it before.

We proved what the Navy /Marine Corps team can do in Iraq, and how fast it can be done. Does anyone really believe that the tasking will decrease anytime in the future?

We have proved how good we are; this means only more will be asked of us.

So….can we be good at fighting a war and maintain hospitals and clinics that meet JCAHO standards? Are the two mutually exclusive?

If they are, what do we need to change so that they aren't?

We have every different training environment that exists at our disposal, but do we utilize them enough?

If you want desert conditions we can go to Twentynine Palms or Texas. Hot and wet, Camp Lejeune or Fort Bragg.

Marines do it all the time, they train with as little as they can, in as many different environments as they can.

They learn to adapt, to overcome. They learned the hard way that you can't count on things or gear. Only on people.

So , how many service members have you seen in your career that you could not send to the field because they would be a liability? How many do you know that can't sustain a forced march or are so overweight that they would be an instant heat casualty outside of an air-conditioned environment. Why don't we look at ourselves and ask the question, could this person save my life if I needed them to?

Could they carry me out of danger? Could they hump out to an evacuation if their vehicle was a casualty? With their gear? With yours too?

I guarantee you that's what the line Marines ask each other.

There are hundreds of years of experience on this deck, but even in this depth of experience, how many of us have really trained in all the environments our services have to offer?

Right now our focus is on the Middle East, but Korea is in the picture. And Africa and Afghanistan are still there.

We have a lot to look at and plan for. Unfortunately, the other guys have plans too, even if they don't always work out. We found out after the war that the Iraqi's had tried to swamp convoys in the south by loading their troops into unarmored vehicles and just charging U.S. positions. For some reason this did not turn out to be successful for the Iraqi troops. I believe the Marines that experienced this referred to it as a "target rich environment."

So the Iraqi's changed tactics based on this unpleasant experience and that is what we faced on the day the photo that brought me here was taken. Iraqi military personnel began to kidnap families from homes and vehicles from the road, forcing them into U.S. checkpoints and security posts, hoping to swamp us during the distraction.

On that day, the convoy had been stopped long enough for a firm security point to have been set up at either end of the column. A large sedan approached, along the road from the north. The HET (humanitarian exploitation team) was telling them to stop and turn around or to exit the vehicle and be searched. The vehicle was slowing, apparently to comply when fire erupted from further north, striking both the vehicle and our positions. When my Marines returned fire they suppressed the attack quickly; they also stopped the vehicle cold. These young men were horrified when they found that the vehicle contained a young family with two children.

Screams for "Corpsman Up" filled the air and every corpsmen in three companies responded, as well as both battalion physicians.

The first patient to be brought back behind secured lines was a little girl. One of her eyes had been destroyed by shrapnel, and she had penetrating wounds to both her chest and abdomen. These types of multiple wounds are common when a large caliber round travels through a vehicle. HM1 Richmond, the other IDC with the unit, held the little girl, calming her, like he would his own daughter. He has one about the same age. She was examined, and Drs. Thomas and Davidson managed to get the girl stable in record time.

The father was treated for a wound to the leg while the HET team determined why he was charging the security point. It became obvious during the exam that all their wounds had come from the back. The doctors and HM1 Richmond were still occupied with the little girl when the second child was brought up a few minutes later. The little boy was dressed in his sister's hand me downs, a pink cotton body warmer that was covered with blood. He was stiff as a board, breathing shallowly and quickly like a terrified animal. But we found no real wounds on him other than some superficial scratches from shrapnel. His lungs were clear, his belly soft, no obvious fractures, heart going strong but beating like a trip hammer.

That has got to be one of the worst feelings you can have in an emergency. There is something wrong. You know it in your gut, but you can't find it. This desperate feedback loop of questions flies through your head accompanied by the increasing fear that this kid is going to die, right there in your lap. Somehow, from somewhere, a moment of logic pokes its head through. This is someone else's blood. Someone must have been holding him when they were hit. Someone had been holding this boy and their blood covered him.

Once we got it though our thick heads that the boy was uninjured we knew there had to be at least one other patient out there. Judging from the amount of blood on the boy, that someone was possibly critically injured. We gave

the boy to one of the other corpsmen for monitoring and shouted for clearance to approach the vehicle. We were already running as the Marines were shouting, "You've got it Doc, go!"

I looked to the right and left and HM2 Dyke, HM2 Webb, and HM3 Lanyon were right by my side. I hadn't asked them. I don't even think I made it clear what was on my mind. They just knew what had to be done and they weren't about to let me go on my own. Our Marines formed up on us as we ran like it was a practiced maneuver. The vehicle had been punched full of holes from behind, but only the radiator grill showed damage from the front. A .50 caliber round had stopped the engine permanently. The other patient turned out to have been the boy's mother, and she was dead.

She had shielded the boy with her own body. A heavy caliber round had come in through her back and out through her chest exploding her heart's blood onto her own child. There was nothing we could do for her except try to preserve her dignity as best we could. She never had a chance.

The Marines providing security for us then brought us the Iraqi soldiers that had been injured in their failed assault. Ladies and gentlemen, you could see the outrage at what had been done to that family in the eyes of these young men, but these 19-, 20-, and 21-year-old Marines and Sailors treated those Iraqi soldiers with all the respect and dignity that hadn't been shown the mother, father, and two children that had been forced into our checkpoint. No matter what they felt, what they wanted to do, they were professional. Those young men were U.S. Marines and U.S. Navy corpsmen in every way that you could possibly want them to be. No matter what was thrown at them, they figured out how to deal with it. They problem solved. They figured it out together.

As we get smaller, move faster, make do with less, this will be a skill we will need to hone. Problem solving is at the most basic level—the company corpsman. Then bring that problem solving ability up the line, bit by bit. Take it out in the field and break it. Then fix it and try again, and again, and again. The Hospital Corps has changed since I joined in 1983. Our mission has changed, and continues to change, but the basics haven't, and the people haven't. You give them the tools and they will give you the world on a platter and ask you if you want fries with that—or they will as soon as fries can be found in an MRE.

Pictures like the one on the back of your program tell only a portion of the story. They show a moment in time focusing on the foreground, but often it's the rest of the story, the one in the background, the one that shows the whole team that truly means something. The accomplishments of that team are my privilege to share with you today. The accomplishments of the team of doctor's, corpsmen, and Marines that fight to save lives, and, occasionally, nations.

Everyone of us has known our entire career that teamwork is what the Navy is about. That team building starts in Officer Candidate School (OCS) or boot camp. Our missions couldn't be accomplished without it. But how many of us stop to really contemplate the concept before the moment our lives depend on it?

It's one thing to work together in an ER, operating room, clinic, or even in the field during a training exercise, but it's a whole different appreciation of that word—that concept—when you know that the Marine or Sailor next to you will do everything in their power to keep you safe, keep you alive, including placing themselves in harm's way to do so.

There is a stereotype that two different militaries exist, both a peacetime and wartime military. Those stereotypes exist for a reason. How can we break this trend without compromising the services that must be maintained in CONUS in peacetime?

If there is any insight that I can give you, any bit of information that might help you in some way in the future I hope it can be this. If you build the team . . . if you can give your people all the training they can handle . . . and then a little bit more, then turn them loose with the tools to do the job.

There will continue to be nothing in the world more awesome, more effective, than the U.S. Navy/Marine Corps Team. They will never let you, or each other down. ❑

HM1 Barnett is assigned as Independent Duty Corpsman, Branch Navy Medical Clinic, San Nicolas Island, CA.

Navy medicine mourns the loss of HM3 David Moreno, who was killed in Al-Hamishya, Iraq on 17 July. He was 26.

Project Windstorm
A Cold War Memoir

CAPT James Helsper, MC, USNR (Ret.)

Part V

Photos courtesy of author

A patient is loaded aboard R5D for medevac off the island.

The left wing began to tilt downward and the senior pilot reached up to feather the propeller on the dead left engine to reduce the drag. Instead, he reached for the red feather button for the right engine. The LTJG slammed his hand away, with a loud expletive, and then pushed the left feather button.

He screamed, "Dead foot, dead engine!" At the same time he grabbed the wheel and moved it to the right, trying to get the left wing up. We had already begun an uncontrollable turn toward the mountain, and it looked like we were going to fall into the death spiral talked about in every multi-engine flying course. The pilot had lost it completely and was now nursing his injured arm. The wing slowly came up and we began a very gentle turn away from the mountain. I could see that we were also slowly losing altitude. As we leveled off we stopped the descent and were able to maintain what little altitude we had. We made a huge circle out over the

water and gradually came around and landed on the runway we had just left.

This happened so quickly that only the two pilots, the engineer up in his pylon seat, and I were aware of what had taken place. We had taxied back and all of us deplaned. No one said anything, but I was in a cold sweat! By late afternoon the mechanics had repaired the left engine, and we had an uneventful flight back to Amchitka (with a different senior pilot).

On arrival we noted that a sign had been placed over the hangar door. Under the bumblebee emblem it read, "Welcome to Amchitka, the Florida of the Aleutian Islands, U.S. Naval Construction Battalion No. 3." Interestingly, "the Florida of the Aleutians" had winds of 40 knots gusting to 70 knots, and the temperature was 35 degrees, with sleet. The reason for the name was that Amchitka was the most southern of all the Aleutian Islands; that didn't make it better, however.

There were many eager hands to help unload the plane, and those strange unmarked cases disappeared with alacrity. The men seemed happier after that. The corpsmen took the new gear to the infirmary and stayed up half the night installing it. They had a definite, new, confident, even cocky, attitude now. They knew they were good, and now they would be able to help us take care of any medical problem. Gus stayed up half the night, too, learning the intricacies of our new anesthesia machine. Dick and I couldn't wait to use our new operating room equipment.

The sign and paint shop further enhanced our pride in the medical facilities by creating a sign, using a bright blue background and gold lettering: "U.S. Naval Infirmary." Everything was going pretty well with our new equipment, and everyone knew that an illness or injury was not going to get you off the island.

However, we finally met our match. A rigger at the site fell and fractured his femur; the fracture ends were pointing out through his skin, a grotesque sight for the other men. Ordinarily we were not allowed out to view the worksite; it was still a secret. But this was different. He was in considerable pain, and was brought to the infirmary by our ambulance.

We x-rayed the fracture and several other painful areas, and with the help of our new anesthesia machine we were able to place him into a Thomas splint, which relieved his pain. The fracture was confirmed to be compound in nature, with bone protruding through the skin and markedly overriding. We could see he was going to need some major orthopedic talent that neither of us had, and he would be months in recovery before going back to duty. The Thomas splint failed to reduce the fracture significantly, as we expected, and we had the

Dead seal on the beach.

carpenter create a balanced traction over his hospital bed. It became obvious that we would have to evacuate this young man for appropriate care in a regular hospital.

Our dilemma was shared with the skipper, and arrangements were made for a Navy transport plane. The military still insisted in caring for their own at service hospitals (thus Navy personnel to Navy hospitals, and Army personnel to Army hospitals), as there was no joint service agreement at that time.

A Navy R5D (DC-4), a four-engine Douglas-built non-pressurized land plane) flew in the next day with a medevac nurse on board. She, of course, created much stir—one woman, more than a thousand men. "Woman smell" was the word flashed through the camp. Everyone tried to go by the infirmary or the plane to see a real lady. None got more than a fleeting glance except Dick and I, who discovered she was a grandmother with a long history of naval service.

The patient was getting antibiotics on a 4-hour basis, and pain relief as needed. It was quite a challenge to get his stretcher into the plane, since the iron ladder ordinarily used was not possible here. The Seabees solved the problem by raising his stretcher to the door with a forklift. We were confident that he would receive good care on the journey to the hospital, and shipped him off with his x-rays.

He was flown to Naval Hospital Bremerton, WA, where he made a nice recovery, and was able to walk without a limp. (We found him completely recovered, at Port Hueneme, on our return from the mission.)

The next medevac was a young man who became ill with an infection. Despite our best efforts, he failed to improve. We were unable to localize the source of the infection, and felt he was more than we should be handling, with our somewhat limited resources. Dick wanted to go with him, since we were unable to obtain a regular medevac plane. This patient was flown out on the next supply PBY, and Dick went with him to Adak. From there, he was picked up by the medevac team and flown to the Air Force hospital in Anchorage. He required an extensive work-up, eventually had surgery, and recovered. He, also, was shipped back to Port Hueneme, as it was felt he couldn't withstand the rigors of the Aleutian climate again.

Our final medevac was the skipper himself. Dick performed the examination and the skipper was found to have a mass in the abdomen. X-rays and laboratory studies were done, and then I was called in to examine him also. We both felt the mass probably represented stool in the cecum, and advised a mild laxative, with re-examination the following day. The skipper felt he wanted another opinion, and transferred himself to the Naval Hospital in Bremerton, where barium enema was negative. He returned to Amchitka in a few days.

This was the entire extent of our medical evacuations for the time we were on the island, and we were pleased with this record, considering all we were faced with. Our inpatient infirmary census was never more than six or eight patients, most of whom had upper respiratory infections or accidents and surgical recoveries.

After breakfast in the hangar we went down to the infirmary to run the daily sick call in our trusty winterized jeep, careful to avoid the tundra. The first big rush was falling off now that everyone knew there was no reason to fake illness, hoping to get off the island; not many real illnesses or injuries qualified to get off the island. The general tenor was to get the job done, and then we could all go home.

After the usual colds and sore throats, a young sheet metal worker who was jaundiced showed up. The corpsmen running sick call brought both of us into this diagnostic challenge. The young man told us he thought he had the flu for 4 or 5 days, with aches and pains for the past 2, along with chills and fever. He had lost his appetite but there were no other significant symptoms. Dick and I did an extensive system review, trying to get some clue. We had been on the island for more than 60 days, beyond the usual incubation period for infectious hepatitis, a common cause of jaundice, and certainly there was no one else known to have jaundice. He slept in one of the quonsets in a lower bunk, and no one else in the quonset was ill. We even sent out a corpsman to interview his roommates, and no illness was uncovered. He was too young for gallbladder stones, and was not a likely candidate for any tumors as the cause of his jaundice. He hadn't cut himself in the sheet metal shop. His temperature was 101 degrees, with a pulse rate of 100, and, indeed, he looked quite ill. There were no other significant findings—no tender liver and no enlarged lymph nodes were noted. We did laboratory studies, and blood was found in his urine. The CBC showed only an elevated white count. There were other tests we would like to have done, but these were not available on the island.

Closeted in our office, Dick and I reviewed *Cecil's Medicine* (the gospel textbook of medical illnesses at the time), checking all the possible causes for jaundice. We had both used this same textbook in medical school. Almost at the same time we arrived at the same answer: here we were in the Rat Islands, and the patient slept in a

lower bunk with his hand occasionally in contact with the floor. We raced out of the office to see if he had a small sore on his hand from a rat bite as he slept. Sure enough, there was a small healing lesion on the fifth finger of his right hand, the hand that occasionally came in contact with the floor as he slept. The patient had leptospirosis icterohemorrhagica, also known as Weil's disease or Rat Bite Fever. There was no doubt in our minds, be we wondered how to prove it. There was a serum test (Weil test), but we had no equipment to perform the test. We would have to take blood samples from the patient and ship them down to Anchorage on the next plane.

Meanwhile, the treatment was clear in the textbook, and we had what was necessary to treat him. The disease is caused by a spirochete which, under the microscope, looks a little like the cause of syphilis. It is successfully treated with penicillin. We read further about the disease's symptoms and learned that if untreated, it can lead to increasing hemorrhages, even to the point of hemorrhagic pneumonia, with multiple bleeding sites all over the body, usually fatal. The blood in the patient's urine was another indicator, and we set up a dark field microscope to visualize bacteria, but this was never successful despite the long searches by several corpsmen, Dick, and I.

This case, after daily sick report, was submitted to the skipper and the senior officers in the hangar, and eventually became the talk of the whole battalion. "Louie has some terrible infection and may die in this f----n place!"

Louie was moved to a private room and isolated because of the infection potential. However, Dick and I visited him so often, trying to see if our treatment was working, that he didn't have time to be lonely. Thankfully, he improved almost immediately, and we could see the jaundice fade from day to day, as he began to feel better. Since we had no means to know when he became free of the spirochetes, we treated him for more than 2 weeks with high doses of penicillin. We were relieved he never showed any progression to the awful complication described in the medical text, and finally discharged him, long after he was feeling well. He subsequently remained healthy.

Discussion in the daily meetings concerned ways to exterminate the rats, from the use of rat poison to planting dynamite at the dump; target practice around the dump was forbidden.

A few days later, as we were just finishing up afternoon sick call, a corpsman came running to summon me to the ambulance entrance immediately. I raced there to find "Sea Otter" Jones, with tears in his eyes, holding a very sick looking sea otter. He was obviously very upset. He said that all the sea otters in his pens were sick, and many had died. He asked me to do a post-mortem on this animal. I had assisted on several human post-mortems during my training, with the staff pathologist, but never on a sea otter! This didn't seem to deter "Sea Otter" Jones at all, and he was convinced that from a post-mortem examination we would be able to determine what was killing his beloved sea otters. The sea otter died as we stood there talking.

With pleading in his voice and more tears in his eyes, he prevailed upon me to find out what was going on. Dick and I finally agreed.

We put on our surgical gowns, gloves, and masks, hoping not to catch from the otter what we had learned about leptospirosis. We found some formaldehyde, and proceeded to do a post-mortem on the still warm animal. We took blood samples and samples of all the tissues to send down to Anchorage. During the autopsy we found nothing unusual except that the kidney capsules didn't strip like they were supposed to. We came away with nothing specific that we could name as the cause of death. "Sea Otter" put the remains of the animal in a bag and went off to bury it. At least he had stopped crying.

We discarded all our clothing articles, burned them, and then scrubbed ourselves extensively in the steam room, using OR scrub soap, hoping that if it were leptospirosis, we had avoided infecting ourselves.

A plane came that evening and, after spending the night, took off the next morning with all our specimens, those from our jaundiced patient and the expired sea otter. It was a long way to Anchorage, but within the week we received word that all specimens were positive for leptospirosis.

So that was what was killing the sea otters. Almost immediately "Sea Otter" Jones came looking for help for his sick animals, and we immediately radioed for more supplies of penicillin. Mr. Jones asked me to go with him to his secret beach, where his captured sea otters were caged, so we could inject them with long-acting penicillin in an effort to curb the epidemic. It was way off the beaten track, and I feared that his truck would suffer the fate of the bulldozer. However, we made it across the tundra to his secret location where he had about 50 pens filled with sick sea otters.

We started with the healthy looking ones, and injected each with a large dose of penicillin in oil, so that it would last for a while. I wanted to leave the sick ones, but we heeded Mr. Jones' pleas, even though injecting

them all significantly reduced our stores of penicillin. At least he held the sick creatures, and I avoided getting bitten. I even persuaded "Sea Otter" to get a dose of penicillin himself before we carefully drove back across the tundra and home.

Now the eradication of the rats began to get everyone's attention. We held a more serious discussion but yielded no results.

Later, as we were reading in our joint office, Dick whooped (as he frequently did on matters of importance), "Hey, hey, hey I've got it!" He was reading a copy of *The Saturday Evening Post*, dated November 10th, 1945 (not the most in-depth medical journal, to be sure). The magazine was one of a stack left over from the Army's previous occupation of the island. "This is it right here: 'the most effective rat poison known to man. Rats eating dead rats, up to 20 generations will die with this new rat poison,'" he continued. "It's right here. We can kill all the rats with one fell swoop. This is the most toxic poison known to man and will wipe out generations of rats in a single planting of the bait."

Wow! It sure seemed like the answer, as I grabbed the magazine and read it through. Neither of us, of course, had ever been exposed to any attempts to eradicate anything before, and neither of us could remember if we had ever had a lecture on this subject in medical school. But here was the answer to our problem in one of America's most respected magazines! Who could say when the next human case of leptospirosis would appear, and, in the meantime, it was surely decimating the sea otter population, one of America's most protected animals. Even though the poison material sounded kind of dangerous, we would rid the world of rats, or at least those in Amchitka, and thus wipe out leptospirosis. We might even be heroes, saving the sea otters for posterity.

By this time we were aware of our rather privileged status, with this "vital work" for the military and the Atomic Energy Commission. After our successful raid on Adak's infirmary, it appeared that we could have anything we needed. There seemed to be some kind of code word that went with our requests, assuring a "yes" from those in authority to grant requisitions. When we requested "1 pound of 1080" I'm sure some would have denied it, but with our status the answer was "yes."

An ominous looking container arrived on the next plane, complete with skull and crossbones all over it. Signs read: "Do not open unless properly trained in use" and "Severely toxic." This was obviously tough stuff! Dick and I had second thoughts as we brought the container back to the infirmary and promptly took it outside to open it. It was about the size of a 10-gallon drum. For only 1 pound, it must be a very secure container, and it was. We opened the outer container and found a smaller sealed container inside with an instruction book for handling compound 1080, "the most toxic poison known to man." We read the book through, both of us now thoroughly respectful of the nature of this material. There were still two more containers to open, before the last one which held the 1-pound container of poison.

It would be very important to open this last container somewhere totally out of the wind, and separated from all habitation. We selected an unused quonset. With 300 pounds of hamburger mixed with sliced raw apples (as recommended in the book), we carefully blended in half the poison. We wore hospital caps, masks, and gowns, and wore rubber gloves, all of which were later buried. Even the giant pots we used to mix the bait were buried. We sealed the remaining half-pound of poison and, after replacing it in the triple container, buried that also.

The poisoned bait was transported to the dump by ambulance, and each corpsman took a pail and spread it from one end of the dump to the other, using tablespoons of the bait thrown into holes and crevices. Then we buried the tablespoons and pails.

We could hardly wait until the next morning to see what we had accomplished. We drove to the dump and got out of the ambulance just in time to see a bird fall from the sky. There was a dead rat in every square foot around the dump, and dead silver foxes and wild dogs as well. Other birds would fall into the sea. At the foot of the dump there were dead fish washed ashore, and even a dead seal on the beach. We immediately cordoned off the area and restricted access for everyone wondering just how long this would go on?

There were no more cases of leptospirosis, and "Sea Otter" Jones told us that his sea otters were no longer dying.

We felt that we had used a 16-inch cannon to destroy a few rats, and considered ourselves very lucky that no human harm came of this venture. The compound 1080 was later withdrawn from the market completely. No one could use it, as it was considered much too toxic. (To be continued) ❑

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The Lone Eagle as Medical Researcher

CDR John W. Nelson, MC, USN

On 23 September 1966, LT Vernon Perry, Director of the Tissue Bank of the Navy Medical Research Institute, Bethesda, MD, wrote with excitement to the designer of a unique pump, an engineering and biomechanical innovation. It was a pump that allowed organs to remain "alive" outside the body. In LT Perry's words:

Three weeks ago . . . we managed to get a . . . heart from a monkey . . . and placed it in the pump. We were interested to see if a pH change could be observed in the media after prolonged perfusion. You can imagine our surprise when after one hour of perfusion at room temperature; the heart began to beat independent of the pulsation of your pump. I don't mean that the heart merely fibrillated; there were strong synchronous auricular ventricular contractions. The heart continued to beat for six hours . . . (1)

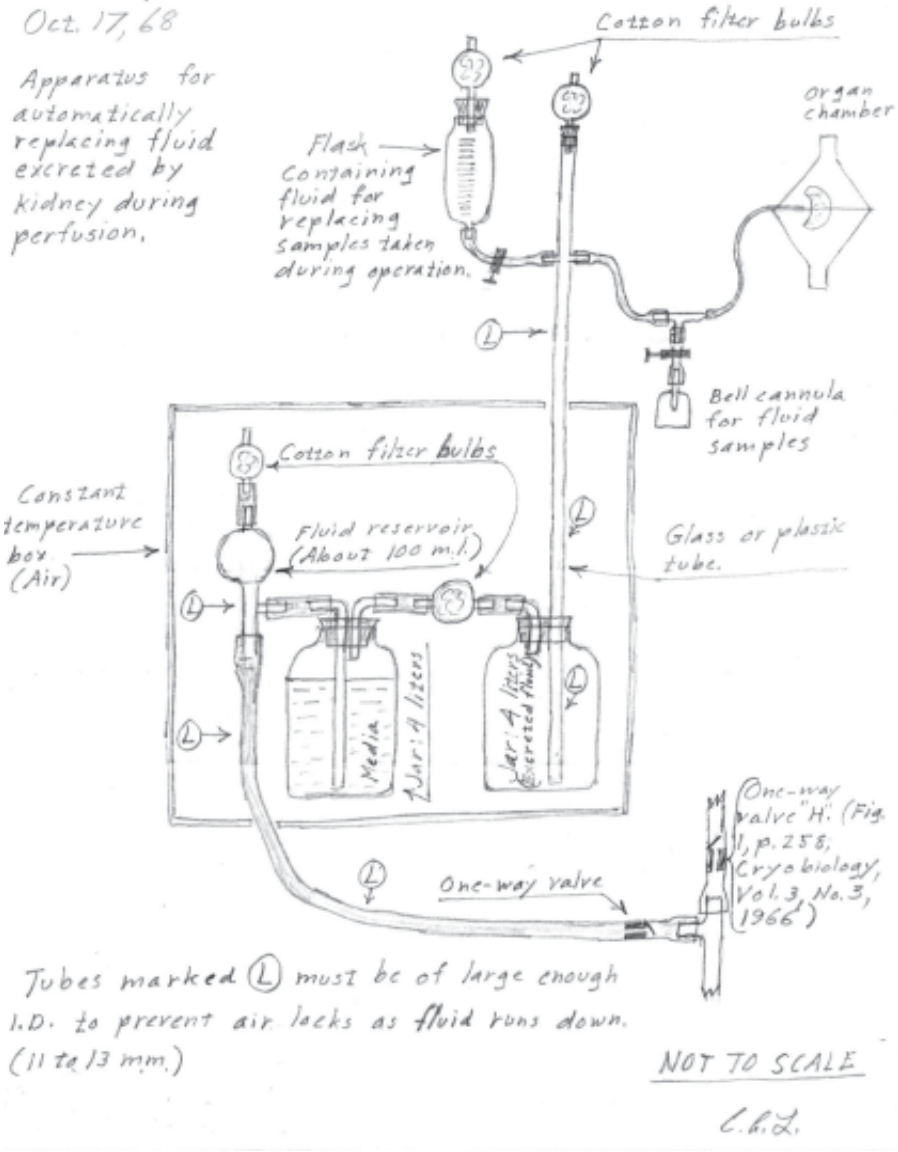
The recipient of the letter, Charles A. Lindbergh was pleased, but not surprised by the report. The idea for the Carrel-Lindbergh perfusion pump was first conceived in the late 1920s and completed in the early 1930s. By the time Lindbergh received Perry's correspondence, the pump had been used successfully in thousands of experiments where sterile conditions and fine control of physiological operating parameters were essential for tissue and whole organ perfusion.

Photo from www.charleslindbergh.com

One of Charles Lindbergh's glass perfusion pumps.

As was the case with most of his pursuits, the genesis of Lindbergh's interest in biomedical research can be found in personal challenge. In 1929 his sister-in-law was diagnosed with rheumatic heart disease, a disease that carried with it a poor prognosis due primarily to an inability to perform surgical procedures on a beating heart. Once Lindbergh learned that the lack of the surgeon's ability to provide artificial mechanical means of circulating oxygenated blood prevented a cure, he "made up his mind to design a pump capable of circulating blood through the body while the heart was being repaired."(*2*) Lindbergh enjoyed a reputation as a talented biologist due, in large part, to his work with the United States Department of Agriculture on spore and bacteria surveys of North America, but he had no medical training whatsoever. He studied engineering briefly at the University of Wisconsin, but became disillusioned with "the limits" of formal engineering education and left school prior to completion of his degree, remaining "unencumbered by the accumulated school wisdom that might have discouraged him from the very onset."(*2*)

Armed with his ideas, an innovative mind, and spirit of adventure, Lindbergh pursued his goal of designing and building a mechanical heart/lung machine. For more than 100 years, physiologists had tried to maintain organs alive outside the body with no real success. French physician, scientist and philosopher Julien-Jean-Cesar Legallois (1770-1814) predicted: "If one could substitute for the heart some kind of injection . . . of arterial blood, either natural or artificially made . . . one could succeed easily in maintaining alive indefinitely any part of the body."(*3*) Knowing this, Lindbergh presented his concept to a number of physician acquaintances, one of whom arranged a meeting with Dr. Alexis Carrel of the Rockefeller Institute. Lindbergh knew of and respected Carrel whose research emphasized blood vessel suture



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Lindbergh's drawing of his perfusion pump dated October 17, 1968

techniques (for which he was awarded the 1912 Nobel Prize in Medicine), and the culture of cells. Carrel was a pioneer in tissue culture research and wrote prolifically on the subject from the early 1920s. While Carrel's work in the culturing of cells had been ground breaking, he was unable to proceed into the areas of tissue and whole organ culture. He was keenly aware of the technical problems associated with organ perfusion in general, and with cardiopulmonary bypass in particular, most notably the need to add oxygen into the perfusate, a problem finally solved in 1953 by Dr. John Gibbons, the first to use such a bypass system successfully on a patient.(*2*)

Like many researchers before him, Carrel found that there was no apparatus capable of playing the role of heart and lungs while keeping an organ free from infection. Carrel had been searching for a system that could be used to maintain live cells and tissue outside the body in order to study cell growth and tissue endocrine response. As of 1929, however, all attempts had failed despite the ready availability of biologically based engineering talent within the Rockefeller Institute. His concept was to ". . . maintain tissues in a condition of uninterrupted growth in a medium that does not deteriorate spontaneously . . . . The problem consists of giving the cells the necessary food material and removing the catabolic substances from the medium without disturbing the tissues and without [introducing] bacterial contamination."(*4*) Overwhelming sepsis (bacterial infection of the tissues under study) quickly ended all of Carrel's earlier attempts.

Indeed, while the study of tissue culture received much attention for its potential, the actual results had been disappointing. The admission of these failures was a recurring theme in the related literature of this period (1923-1925), best demonstrated by an editorial commenting on Carrel's presentation to the British Medical Association of Pathology and Bacteriology Section Meeting of 1924. It begins optimistically . . . "Dr. Alexis Carrel may be perhaps considered the leader of a small band of workers who have given much time to a line of inquiry which is not only of obvious importance to biologists in general and to followers of medicine and pathology in particular . . . That the cells of complex animals can be persuaded to live and multiply under a cover glass . . . is astonishing."(*5*) But, having reviewed Carrel's results, the editorial closed rather quietly, referring only to "hopeful" possibilities for the future of this type of research.

With this lack of success as a background, Carrel received Lindbergh's idea with interest, if not for its originality of concept, then certainly because of Lindbergh's record of results

in other fields. While he believed that Lindbergh offered a unique engineering approach to the problem, Carrel also appreciated the public relations potential of a collaboration with Lindbergh. Surely, publicity associated with Lindbergh could help assure the continuation of his research and enhance his reputation as a scientist. One is left to wonder, for example, if Carrel would have appeared on the 13 July 1938 cover of *TIME* magazine were it not for Lindbergh's popularity as a national hero. Charles Lindbergh's stature as a public figure during this time in American history cannot be overstated. Indeed Lindbergh himself did not fully appreciate the magnitude and strength of his public appeal and popularity, popularity that he ironically tried to avoid from the time of his famous flight until his death in 1974. Many of Carrel's colleagues at the Rockefeller Institute privately questioned the scientific value of Lindbergh's contribution when their collaboration was first announced. "Some of the senior members were inclined to disapprove of the introduction of an amateur to the select ranks of medical investigator; others feared sensational publicity."(*6*) Others were openly critical, denouncing the partnership as a publicity stunt, rather than a scientific collaboration. However, Lindbergh carried out his work with "modesty and discretion," publishing his early findings anonymously. In fact, no public announcement of Lindbergh's presence at the institute was made until mid-1935.

Carrel's previous experience in the field of cell profusion revealed the overly ambitious nature of Lindbergh's original plan.(*7*) He convinced the inventor that, instead of venturing immediately into a difficult and unexplored field of heart lung bypass, "it was wiser to attempt the culture of whole organs, which could become an almost immediate reality . . . ."(*2*) He knew that, whether or not the treatment of diseased human organs by exchange or replacement ever became possible, "the really important application of the method would not be in the field of surgery, but in physiology . . . ,"(*6*) a tool to fulfill Carrel's wish to "study the interplay between organ, blood, and lymph."(*2*)

Lindbergh's first contribution to the field of biomedical research was the invention of a gas-lift culture flask allowing the continuous circulation of fluid medium. This device was used extensively by Rockefeller Institute researchers in their early biological studies of tissue physiology. It represented an improvement to an earlier Rockefeller Institute system that utilized an all glass design but which failed because of bacterial contamination.(*6*) In one study using the Lindbergh system, Carrel's team maintained a culture of epithelium viable for more than 100 days, during which he was able to observe the culture "under the highest power of the microscope." Lindbergh next developed a simple and effective technique for separating serum from plasma and a device for washing suspended blood cells in a centrifuge.(*8*)

Based on the success of their initial collaboration, Lindbergh and Carrel undertook an ambitious project: the perfusion of whole organs. As Lindbergh wrote in 1965, their plan was set to proceed in three stages: "First, the development of a pulsating perfusion pump that would approximately duplicate natural pressures, and in which infection could be excluded. Second, the development of surgical and chemical techniques related to installation of the organ and the perfusing fluid. Third, the application of the method to research projects."(*9*)

Lindbergh's major contribution was introduced in a paper published jointly with Carrel in which he describes an all-glass system for the perfusion of whole organs. It is in the design and manufacture of this device that Lindbergh's skills as a biomedical engineer are best demonstrated. Based on lessons learned from previous versions, and using the diverse talents of Rockefeller Institute colleagues, he was able to deliver an apparatus that met all of Carrel's strict criteria. It was ultimately used, as Lindbergh recalled, in "over a thousand perfusion experiments."(*9*) Lindbergh's design provided careful environmental control, allowed researchers to add or remove tissue and perfusion fluid from the system without interrupting operations, allowed microscopic viewing of the tissues *in vitro*, and provided an aseptic environment. A working model was first delivered in 1935, followed in 1938 with the publication of *The Culture of Organs*, a work designed to serve as a step-by-step technical manual for fellow researchers. In it, Lindbergh explains that the apparatus . . . "maintains a sterile pulsating circulation through the [living] organs for a length of time limited only by the condition of the organ and the perfusion fluid."(*10*)

Thanks to the technical skill of Rockefeller Institute's glass blowers, Lindbergh designed and built the system entirely of Pyrex glass with rubber stoppers and cotton filters, all with anti-sepsis and ease of cleaning in mind. The system was operated entirely using compressed control gas pressure (oxygen, carbon dioxide, and nitrogen) as a motive force to provide pulsating fluid at adjustable pressure and measurable flow rate. Maintenance of system pressure within strict parameters while allowing the introduction of new profusion fluid and/

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L to R: CDR G.H. Mouer, LT V.P. Perry, C.A. Lindbergh, and T. Malinin view a model of the pump.

or additional specimens was a difficult challenge, yet the originality of Lindbergh's approach exceeded expectations.

Lindbergh's ingenious design required 17 pages of detailed descriptive text and 7 full-page illustrations to adequately describe, in part explaining that the device ". . . has only three openings that communicate with the exterior. These openings are protected against infection by filter bulbs containing non-absorbent cotton. Neither the organ nor the perfusion fluid comes in contact with any stoppers or joints which communicate with the exterior . . .. The composition of all gas in contact with the organ and the perfusion fluid is controlled. Foaming and evaporation of the fluid are prevented. The maximum and minimum pulsation pressures and the pulsation rate are adjustable. The pressure at various points in the pulse cycle can be controlled. The temperature of operation is adjustable. The rate of flow of perfusion fluid can be measured. Changes for rate of flow through the organ are compensated for automatically with a minimum effect on pulsation pressures. The perfusion fluid is filtered during its circulation and before it enters the organ. Organs can be removed from one apparatus and installed in another aseptically. The perfusion fluid can be removed and replaced aseptically. The organ and the perfusion fluid can be observed at all times.(*11*)

With the laboratory success of the pump well established, Carrel and Lindbergh presented their first public demonstration to the Danish Biological Institute, Copenhagen in 1936. While intended to serve as a scientific forum before a relatively small gathering of researchers, the presentation was sensationalized by prior public acknowledgement of Lindbergh's participation. Well covered by the popular press, reports of "impatient hordes waiting to catch a glimpse of the aviator scientist," police barricades, and Lindbergh "dodging in and out of side doors" to avoid the public turned the demonstration into a "Lindbergh public appearance" rather than a scientific symposium. The crowd outside the hall far outnumbered the 250 physicians and biologists who watched the demonstration within. While those in attendance were universally impressed, physicians in Copenhagen and around the world complained that their patients, "expecting magic from the flyer were ordering Lindbergh Hearts to replace their faulty human ones" as a result of misleading news reports.(*12*)

In the months that followed Copenhagen, American, and European labs ordered dozens of Lindbergh pumps, but for various reasons they were not widely used. One reason was a shift within the scientific community toward study at the level of individual cells and away from whole organs and organ systems. Additionally, biochemists found that they could obtain as satisfactory a result from cut sections of organs (which remained viable for a few hours after sectioning) as they could from whole, perfused organs. However, the main reason for the failure of the Lindbergh pump to gain wide use within the scientific community was its difficulty of operation. As a result, virtually all the Lindbergh pumps constructed between 1935 and 1938 had dropped out of use by 1940.(*6*)

Lindbergh continued to work with Carrel to improve the profusion system, including the pump, culture medium, and perfusion fluid, until the early 1940s. Of the original three-step plan previously introduced, Lindbergh wrote with a hint of disappointment, . . . "we had completed (with reasonable satisfaction for preliminary work) the first two stages. The war and Carrel's death prevented our entering

the third. Of course, even in the first two stages much additional development was desirable."(*13*)

While organ profusion, with an eye toward organ transplant, continued to develop within the scientific community after the war, Lindbergh's own active pursuit of further study in the subject ended until persuaded to return to it some 30 years later.

During the 1960s, researchers at the Navy Medical Research Institute (NMRI) Tissue Bank in Bethesda, MD, carried out a series of studies designed to examine the preservation of whole organs, possibly through (then) new freeze-dried technology, for use in transplant at field medical facilities. Based on research performed on skin, bone marrow, and blood, NMRI scientists had concluded that it was possible to freeze-dry and store some tissue grafts for over 10 years, while remaining clinically viable.(*14*) However, work on whole organs presented many daunting problems. Tissue Bank scientists studied all existing research in whole organ perfusion, including that of Lindbergh and Carrel (then held by the Georgetown University Medical Center) and found that they had reported better results than those attained using more recent techniques.(*15*)

The original perfusion pump described by Lindbergh required only minor modifications to work properly at temperatures required for freeze-drying. LT Vernon P. Perry (Director, NMRI Tissue Bank) encouraged Lindbergh to come out of retirement and participate in a collaborative effort toward a pump redesign. Initially, Lindbergh was reluctant, writing from Switzerland in 1965 that ". . . it has been so many years since I have done any lab work in connection with tissue or organ culture that I would have very little to contribute. Although my interests naturally continue in these fields, my last active research dates back to about 1938."(*16*)

After repeated requests, Lindbergh finally agreed, and in 1968 accepted an appointment as a guest scientist at NMRI to resume work on whole organ perfusion. The collaboration produced two publications, "An apparatus for the pulsating perfusion of whole organs" (*17*) and "Maintenance of Continuous Contraction of Mammalian Hearts at Hypothermic Temperatures" (*18*) but ended shortly thereafter when NMRI abandoned their original plan.

It is interesting to note that following the 1936 Copenhagen perfusion pump demonstration, conventional wisdom held that "Lindbergh's work as a scientist would probably be remembered long after his flight to Paris is only a dimly recalled event in aviation history."(*12*) While this has certainly not been the case, Charles Lindbergh's contribution to our body of scientific knowledge is remarkably noteworthy, if not for its lasting benefit to medical research, then for the pioneering, innovative spirit it represents.

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Navigating the Navy Disability Evaluation System

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Navy healthcare providers (NHCPs) frequently encounter personnel with a variety of injuries and illnesses. Although NHCPs are well trained to evaluate, diagnose, and treat many medical problems, few have received formal training with respect to assessment of medical impairment and disability. Several models of disablement have been developed over the years; however, the Nagi model pervades the medical literature and is summarized in Figure 1.(*1, 2*)

In order to appropriately identify and manage active duty and inactive-duty members with disabilities, it is important to understand the Navy's definitions and differences between the terms *impairment* and *disability*. Impairment is a medical term that can be defined as "any disease or residual of an injury that results in a lessening or weakening of the capacity of the body or its parts to perform normally, according to accepted medical principles."(*3*) Impairment may be stratified as being a mild, moderate, or severe condition that can be either temporary or permanent in nature. A medical impairment or physical defect alone does not constitute a disability. In order for a medical impairment or physical defect to be regarded as a disability, it must be "…of such a nature and degree of severity as to interfere with the member's ability to adequately perform his or her duties."(*3*)

Although definition of terms is a necessary first step in the management of disabled personnel, providers must also have a basic understanding of the disability evaluation system to manage these cases efficiently and effectively. According to Marcum, et al, a Department of Defense (DOD) Inspector General audit in 1992 revealed that the Disability Evaluation System

Table 1: Pertinent References for Disability Evaluations
Title 10, United States Code
DoD Directive 1332.18 of 4 Nov 96 (NOTAL)
DoD Instruction 1332.38 of 14 Nov 96 (NOTAL)
DoD Instruction 1332.39 of 14 Nov 96 (NOTAL)
SECNAVINST 1770.3B
SECNAVINST 5212.5D
SECNAVINST 5300.30C
BUPERSINST 1001.39C
Manual of the Medical Department
COMNAVRESFORINST 3060.7
COMNAVRESFORINST 6001.1A

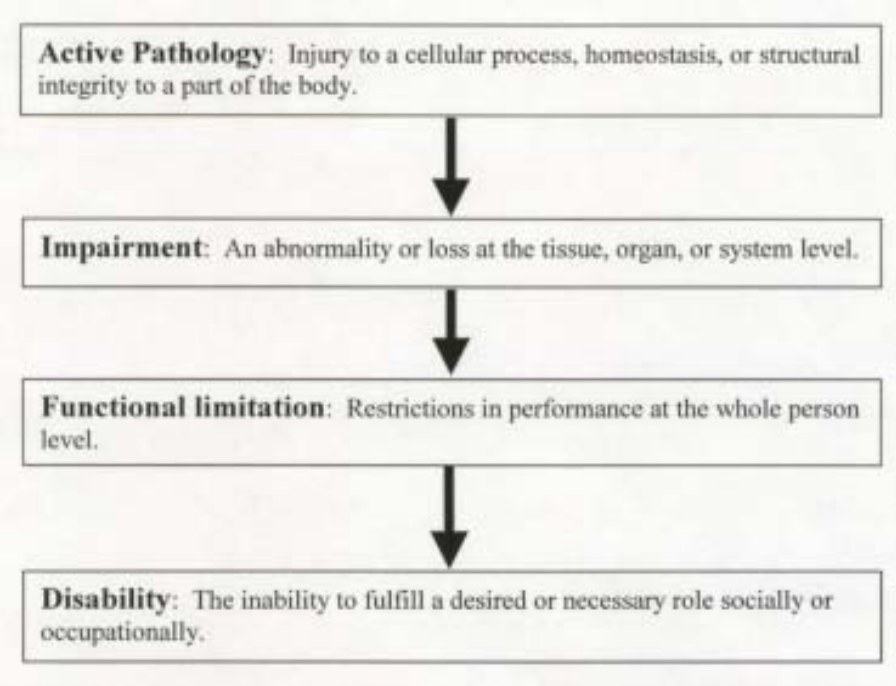

Figure 1. The Nagi model of disablement.(*1,2*)

(DES) was inefficient and that some service members were incorrectly rated for their disabilities.(*4*) A separate communication several years later reported that Selected Reserve medical officers had not been trained adequately regarding physical standards and as a result, some personnel were found to be fit for duty when, in fact, they were not physically qualified according to Navy standards.(*5*) The communiqué recommended that readiness commands establish a 1- day course for medical officers to educate and train them regarding Temporary Not Physically Qualified (TNPQ) determinations, Medical Evaluation Boards (MEB), Physical Evaluation Boards (PEB), and other components of the Navy DES. Therefore, the purpose of this article is to familiarize NHCPs with respect to the Navy's Disability Evaluation System and to identify important differences between active duty personnel and inactive-duty reservists who develop a disability and enter the system for evaluation of their cases.

Medical Evaluation Boards and Physical Evaluation Boards

The DES is DOD's management system used to evaluate service members who develop medical or psychological conditions that potentially impair the member's ability to perform the duties of his/her office, grade, rank, or rating. The DES provides a number of functions critical to the overall success of the military. Such functions include but are not limited to the following: to maintain a fit military force, to provide for compensation and benefits, and to remove unfit members from military duty. The DES is composed of four major elements, i.e., Medical Evaluation Boards, Physical Evaluation Boards, Counseling, and Final Disposition.

All branches of the military have a DES that mirrors the DOD's general program; however, it is important to realize there are significant differences in policy and process across the various branches of service. The major objectives and components of the Navy's DES is similar to that of the DOD. Algorithms that outline the basic disability evaluation process for Navy personnel are depicted in Figure 2 (active duty personnel) and Figure 3 (inactive-duty reservists). Inspection of the algorithms reveals several similarities. For example, MEBs and PEBs are the key elements in the overall processing of active duty and inactive-duty reservists having medical conditions resulting in impairment and disability.

MEBs are composed of a body of physicians or others specifically designated by Chief BUMED to identify members whose physical or mental ability to continue to serve the Navy is in doubt or whose medical or mental limitation precludes their return to full duty in a reasonable period of time.(*3*) MEBs are convened to evaluate and report on diagnosis, prognosis for return to full duty, plans for future treatment, rehabilitation, or convalescence, estimated duration of disability, and render recommendations for medical disposition. Frequent outcomes of the MEB include recommendations for return to duty, referral to the PEB, or return of the case to the treating physician(s) for further evaluation, treatment, or clarification.

As summarized above, individuals who appear permanently disabled for continued service or who are unlikely to resolve their condition in a reasonable period will be referred to the PEB. The PEB acts on behalf of the Secretary of the Navy in making determinations of fitness to continue naval service, entitlements to benefits, and final disposition of service members referred to the board.(*3*) PEB determinations are either records-based (as a result of an informal hearing) or hearing-based (as a result of a formal hearing). Informal and Formal PEBs are composed of three senior members, i.e., a Navy line officer,

Marine Corps officer, and Medical Corps officer. The standard used by the PEB in making determinations of disability is "unfitness to perform the duties of office, grade, rank, or rating because of disease or injury… ."(*3*) The PEB can render a number of final dispositions, but for the purposes of this article, the following are most pertinent:

• Fit: the active duty member is Fit and returned to his/her normal duty.

• Physically Qualified (PQ): the inactive-duty reservist is Physically Qualified and returned to his/her normal reserve status.

• Unfit: the active duty member is found to be Unfit (i.e., physically disabled) and will be retired (if eligible) or separated.

• Not Physically Qualified (NPQ): the inactive-duty reservist who is found to be NPQ will be honorably discharged, retired (if eligible), or offered non-regular retirement (if applicable).

Although the PEB renders a number of final dispositions as stated above, it is important for NHCPs, unit commanders, and ill/injured members to realize that the PEB *does not* determine a member's status for deployability or fitness for special duty assignments, PRT/PFT participation, or administrative action. These determinations must be ascertained through other unrelated procedures.

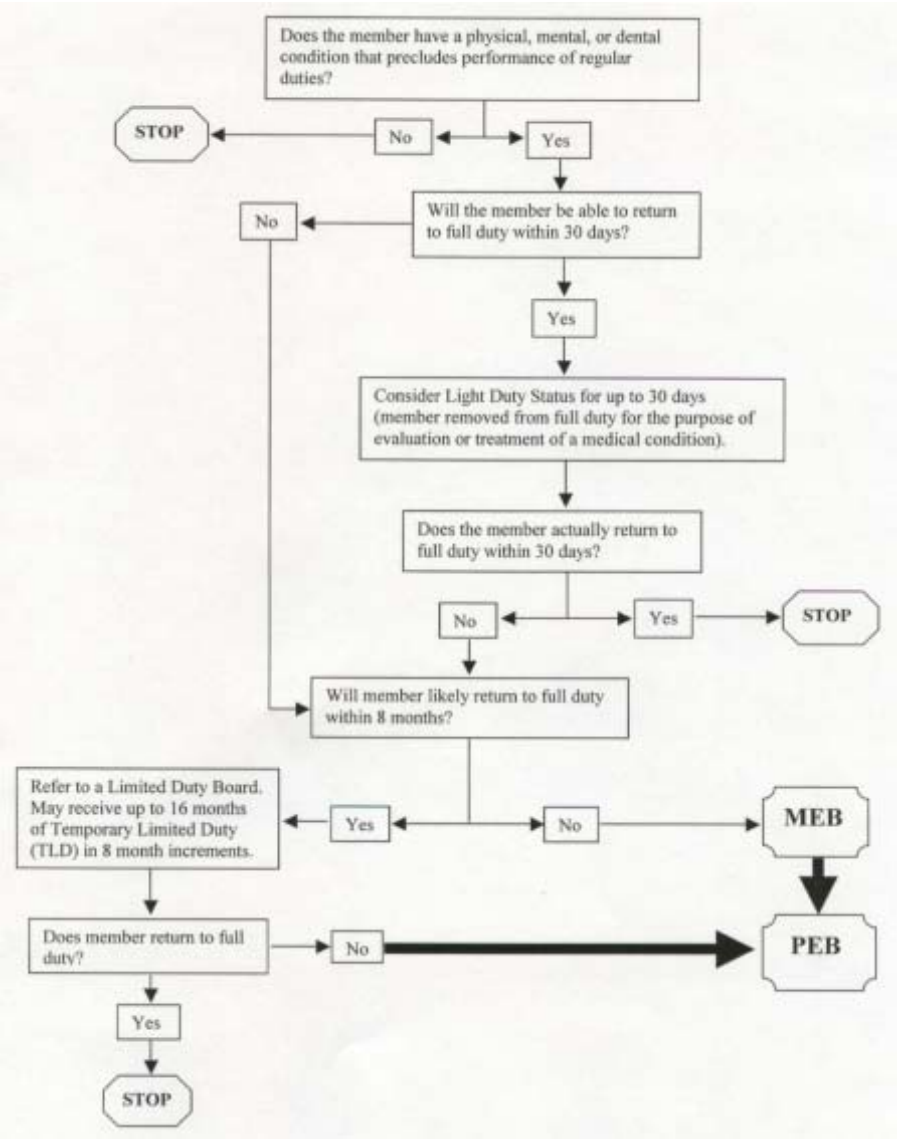

Figure 2. The disability evaluation system for active duty personnel (general process flow).

In regard to procedural differences between active duty members and inactive duty reservists, it is important to note that while Temporary Limited Duty (TLD) is an option for active duty members, there is no TLD for members in a Ready Reserve status. Conversely, the term Temporary Not Physically Qualified (TNPQ) should be reserved for inactive-duty members with a temporary disability, e.g. fractured bone or fractured tooth, which will more than likely resolve within 6 months. In addition to these and other temporal differences, the criteria for referral to the PEB differs for active duty members and inactive-duty reservists. In general, an active duty member or reservist on extended active duty will be referred for a disability evaluation only by a MEB that has found the member's fitness for continued naval service to be questionable. Inactive-duty reservists who have not been awarded a Notice of Eligibility (NOE) and who have been determined by CHBUMED to be NPQ for active duty or retention will be referred at the member's request to an Informal PEB for a final disposition. If the inactive-duty reservist is found to be Unfit by the Informal PEB and assigned a finding of NPQ, the member has the right to request a Formal PEB. In such situations, the member will bear all costs associated with

travel, lodging, meals, and other incidentals necessary to appear before the Formal PEB.

Conclusion

Navy health care providers perform a number of essential functions in the military. First and foremost is the diagnosis and treatment of ill or injured Sailors and Marines. In addition to their traditional medical role, NHCPs are relied upon to optimize the medical readiness of the troops which directly impacts operational readiness of the force. Therefore, it is important for NHCPs to accurately identify personnel with impairments that are likely to be disabling not only to optimize care for the individual but also to initiate referrals to the DES when clinically indicated. Appropriate and timely referral to the DES will serve to balance the needs of the individual and the Navy in a fair and equitable manner.

The Navy disability evaluation system can be complex and confusing to the member, his/her family, and his/her unit; as well as NHCPs who have had little or no training with respect to this system. It is therefore recommended that NHCPs familiarize themselves with the Navy Disability Evaluation Manual (*3)* in addition to the other references listed in Table 1 in order to be effective and optimize outcomes of importance to both the individual and the Navy.

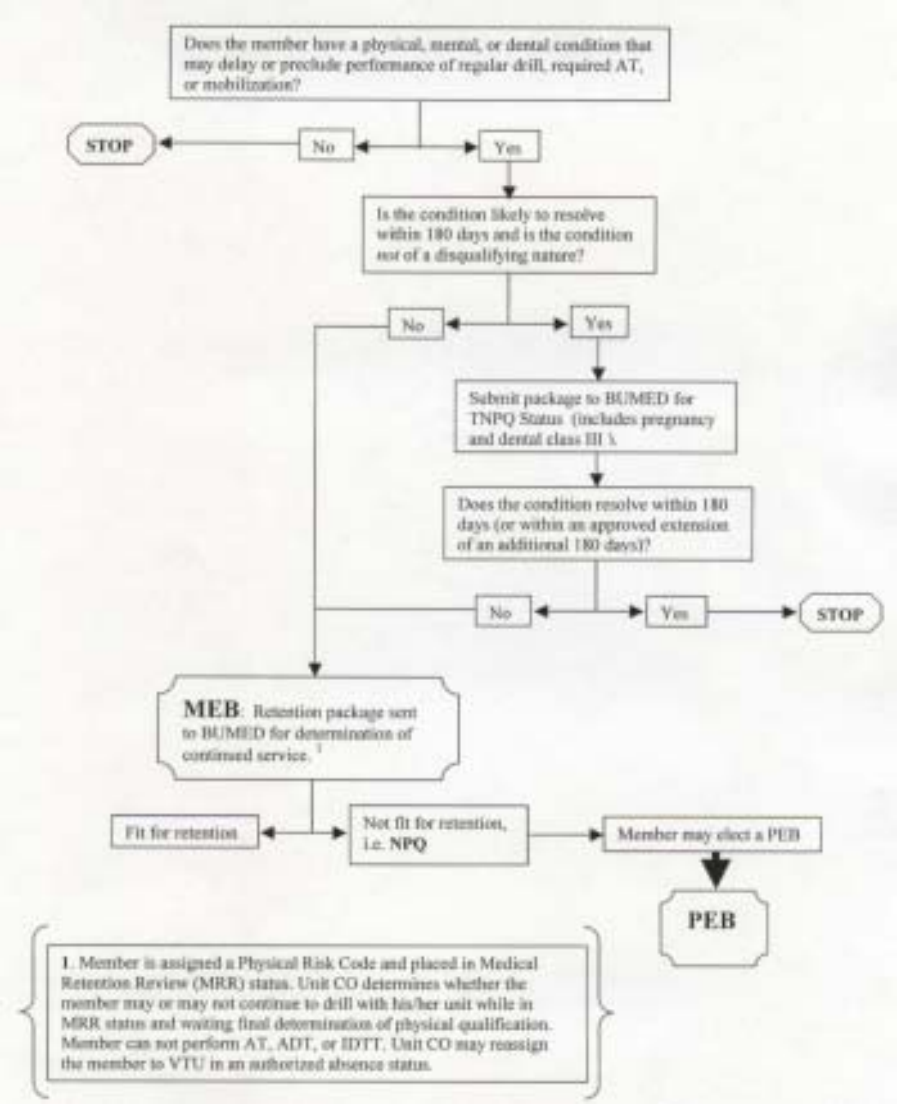

Figure 3. The disability evaluation system for inactive-duty reservists (general process flow).

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The Sleepwalking Sailor

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Sleep problems are increasingly reported by patients and need to be appropriately evaluated by physicians and other healthcare providers. In a previous article (*Navy Medicine*, March-April 2001), we outlined a diagnostic and therapeutic approach to patients with excessive daytime sleepiness.(*1*) In this article, we examine the "parasomnias," a group of sleep disorders that are primarily characterized by unusual or even bizarre sleep behavior as shown in table 1.

Normal Sleep

An understanding of parasomnias requires a working knowledge of normal sleep physiology. Sleep consists of two distinct sleep states termed REM (rapid eye movement) and NREM (non rapid eye movement) sleep. NREM sleep is further subdivided into four stages. Stage 1 marks a somewhat hazy transition from wake to sleep, while unambiguous stage 2 sleep is easily recognized by EEG waveforms know as "K complexes" and "sleep spindles." Slow-wave sleep (stages 3 and 4) is a "deeper," more restorative sleep. REM sleep is deceptively passive. Although parts of the brain display intense activity and the eyes move in bursts, the person lies perfectly still due to active motor inhibition that prevents unrestrained or even violent activity that would otherwise accompany dreaming. Between four and six 90-minute NREM/REM sleep cycles occur each night, and with each successive cycle, the proportion of slow-wave sleep decreases, and REM sleep increases. Thus, most slow-wave NREM sleep occurs in the first part of the sleep period and the majority of REM sleep occurs later. This concept is extremely important, as many parasomnias are inherently tied to specific sleep stages. Therefore, the timing of the abnormal behavior provides an important clue as to the etiology. Finally, it is now recognized that sleep and wakefulness can oscillate rapidly or even meld (features of both occur simultaneously), and that physiologic features of sleep can intrude into wakefulness.

Arousal Disorders

Three related parasomnias are classified as disorders of arousal because the behavior is attributed to incomplete awakening from NREM slow-wave sleep. Recent studies suggest that defective slow-wave sleep regulation mechanisms set the stage for these behaviors and factors such as sleep deprivation, alcohol use, emotional stress, acute illness, and medications may precipitate events in susceptible individuals.(*2*,*3*) Although arousal disorders occur mainly in children, a large population survey found that confusional arousals (8.9 percent), sleep terrors (2.6 percent), and sleepwalking (5 percent) are surprisingly common in young adults.(*4*) Confusional arousals are inappropriate automatic behaviors, such as "turning off the alarm clock when the phone rings" that accompany abrupt awakenings from deep sleep. The person may appear intoxicated, hence the term "sleep drunkenness," and the events are not recalled after awakening. Sleep terrors are dramatic events in which the person abruptly sits up and screams or cries inconsolably. Intense fear is obvious and the person may fight back or attempt to escape from unseen danger, resulting in injury to self or bed partner. The emotional intensity that accompanies sleepwalking (somnambulism) is decidedly less dramatic. Sleepwalkers appear detached and are often noncommunicative, although they can become vocal, belligerent, or even violent when confronted. There have been a number of highly publicized murders that appear to have been committed during sleepwalking epi-

sodes.(*5*) Finally, variants of sleepwalking characterized primarily by sexual activity or eating have been described.(*6,7*)

General recommendations for patients with an arousal disorder include maintaining a regular sleep pattern, avoiding bedtime alcohol use, and attention to safety issues, including locking up all firearms. Roommates should also be warned of the potential for an event and counseled to simply redirect the patient to bed. Hypnosis, psychotherapy, and relaxation techniques may be useful in some cases; however, the habitual aggressive or violent patient may require long-term treatment with a benzodiazepine such as Clonazepam.(*8,9*)

Sleep-Wake Transition Disorders

Rhythmic movement disorders such as head-banging or body-rocking are common in infants and may persist into adulthood in patients with autism or mental retardation. They begin just prior to sleep onset and may continue into light sleep, are self-limited, and don't generally require treatment other than ensuring a safe sleep environment. Sleep starts or hypnagogic jerks are the sudden leg or whole body contractions that commonly occur at the moment of sleep-onset. A flash of light or loud noise may accompany a sensation of falling or floating. Sleep starts do not warrant treatment unless they consistently interfere with sleep-onset. Sleep talking (somniloquy) is common and of little clinical significance although vocalization, such as screaming during a sleep terror or crying with nightmares may also accompany other parasomnias. Nocturnal leg cramps are painful muscle contractions that interrupt sleep and are quite distinct from the uncomfortable, "creepy-crawly" sensations described by patients with restless legs syndrome. Although quinine is not FDA-approved for the treatment of leg cramps, placebo-controlled, double-blind, studies suggest at least modest efficacy.(*10*)

REM-related Parasomnias

The unraveling of REM sleep mechanisms and physiology has opened the door to an understanding of several bizarre sleep behaviors. Dreaming is an integral part of REM sleep, and nightmares are frightening dreams that generally crescendo into an awakening or are vividly recalled later. Nightmares are distinguished from sleep terrors by their timing, complicated dream imagery that is readily recalled, and less intense autonomic manifestations. Frequent nightmares occur more often in individuals with psychiatric disease, following trauma, and with certain medications; they may also predict mental illness and suicide.(*11*)

Sleep paralysis results from normal self-limited REM-sleep-related motor paralysis that persists after awakening. Although sleep paralysis is a feature of narcolepsy, up to one-third of the general population has experienced at least one episode.(*12*) Frequent spells may herald narcolepsy or a familial form of isolated sleep paralysis.

Penile erections are a normal part of REM sleep physiology and occur with each REM cycle in all healthy males. Absent or impaired sleep-related penile erections signify underlying organic pathology and can be diagnosed in a sleep lab capable of measuring nocturnal penile tumescence. The etiology of sleep-related painful erections, reported mainly by middle-aged and elderly men is unknown, although no anatomic or psychiatric pathology has been identified; daytime erections in these patients are not painful.(*13*)

REM-sleep related sinus arrest is probably an extreme manifestation of autonomic variability that normally accompanies REM sleep and has been hypothesized to be a rare cause of sudden, unexplained nocturnal death in healthy young persons.(*14*)

REM behavior disorder (RBD) is a fascinating condition that results when inadequate paralysis during REM sleep allows affected individuals to literally act out their dreams.(*15*) Patients often come to attention only after injuring themselves or frightening their bed partner with recurrent bouts of running, fighting, wrestling, or jumping in bed. When asked to explain their activity, patients provide vivid recall of the dream and their actions. RBD is most often diagnosed in elderly males and may herald underlying Parkinson's disease or other degenerative brain processes.(*16*) Clonazepam is usually effective in suppressing RBD.

Miscellaneous Parasomnias

Parasomnias classified as miscellaneous will not be discussed in this paper.

When to Order a Sleep Study

The diagnosis of abnormal sleep-related behavior relies heavily on history obtained from both the patient and an observer, if possible. Sleep starts, sleep talking, and simple sleepwalking generally don't require confirmation with a sleep study. On the other hand, parasomnias that are complex or violent present a diagnostic and medico-legal challenge, and every effort should be made to establish a definite diagnosis. The differential diagnosis in cases of complex sleep-related behaviors often includes arousal disorders, REM behavior disorder, seizures, dissociative states, and malingering. Routine overnight sleep

studies (known as polysomnography) record multiple physiologic variables including brainwaves (EEG), eye movements (EOG), and muscle tone (EMG), as well as cardiorespiratory parameters. Parasomnia evaluations must include additional EEG leads to maximize the chance of capturing seizure activity and continuous video recording of behavior.(*17*) Unfortunately, sleepwalking and sleep terror episodes are rarely captured in the sleep lab, although frequent arousals from slow-wave sleep suggest the possibility of such an arousal disorder. Attempts to precipitate sleepwalking in the laboratory through sleep deprivation may increase the yield of routine polysomnography.(*18*) Patients with REM behavior disorder often have a distinct increase in baseline EMG activity during REM sleep, an important clue when a typical event is not captured. Nocturnal dissociative states are identified when complex behavioral activity (often mimicking prior trauma or abuse) occurs following an unambiguous period of wakefulness. Due to the unpredictable nature of these complex parasomnias, it is almost impossible to absolutely rule out malingering, and several consecutive nights of monitoring may be required. We also frequently ask patients to consider videotaping themselves in their home environment.

Parasomnias and the Navy

Article 15-54 of the Manual of the Medical Department lists parasomnias among conditions subject to rejection, "Other behavior problems such as authenticated evidence of functional enuresis, *sleepwalking*, *sleep disorders*, *parasomnia*, or eating disorders which are habitual or persistent." The current edition of the Naval Military Personnel Manual, Article 1910-120, identifies *somnambulism* as a condition that does not "amount to a disability, but *can* affect potential for continued Naval service." Other parasomnias are not addressed by MILPERS. The decision to request separation may be either "command-initiated" or "service member-initiated," and must include documentation by a medical officer that the condition renders the member *incapable of completing his/her obligated service (EAOS) in any capacity*, e.g., forced conversion, reassignment, etc.

Case Study

A 21-year-old male Sailor was referred to the sleep lab by his general medical officer for sleepwalking. Although the patient had no recollection of the event, his roommate said that he appeared "like a zombie" and responded only with a grunt when he was found trying to open the back door 30 minutes after going to bed. He also reported waking up on the couch on two occasions after falling asleep in his bed. He denied a history of sleepwalking, but his parents informed him that he had screaming "nightmares" as a child and that his younger brother sleepwalked. The patient had not injured himself and was not belligerent when confronted by his roommate. He denied a history of head trauma, seizures, alcohol, or drug abuse. His physical exam was normal.

This case is typical of many patients referred to our sleep lab for evaluation. In addition to sleepwalking, we considered REM behavior disorder, sleep-related seizures, and malingering. Several historical features strongly suggested sleepwalking: complete amnesia of the events; glassy-eyed, unresponsive appearance; occurrence in the first part of the night; personal history suggesting a closely-related arousal disorder (sleep terrors); and a family history of sleepwalking. REM behavior disorder is very uncommon in this age group, and the timing and inability of the patient to recall or explain his activity was strong evidence against RBD. Seizures were also unlikely in the absence of repetitive, stereotyped motor activity or a history of brain injury or epilepsy. It was impossible to definitively rule out malingering. However, his story was internally consistent, and there was no obvious secondary gain. In this case, we did not perform an overnight sleep study due to compelling historical evidence and benign behavior exhibited by the patient. We reviewed current Navy regulations with the service member and his medical officer and found no evidence that his sleepwalking had interfered with duty performance. We made general safety recommendations, counseled him to avoid sleep deprivation and alcohol, and returned him to duty.

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Table 1: Classification of Parasomnias:

Arousal Disorders	Confusional Arousals Sleep Terrors Sleep Walking
Sleep-Wake Transition Disorders	Rhythmic Movement Disorder Sleep Start Sleep Talking Nocturnal Leg Cramps
Disorders Associated with REM Sleep	Nightmares Sleep Paralysis Impaired Sleep-Related Penile Erections Painful Penile Erections REM-related Sinus Arrest REM-related Behavior Disorder
Miscellaneous Sleep Disorders	Bruxism Sleep Enuresis Paroxysmal Nocturnal Dystonia Sudden Unexplained Nocturnal Death

Navy Medicine Apprenticeships

When the Child Becomes Parent to Recruitment

Andrew Young
Dr. Ed Gabriele

On a March weekday in 1999, Andy Young drove from Ellicott City, MD, to Bethesda, MD. Little did the senior from Centennial High School realize, but that ride would change his life. Centennial High School students had been taking part in the Science and Engineering Apprentice Program (SEAP), a science and technology internship experience of The George Washington University for high school and college students sponsored as a grant by the Office of Naval Research. Andy became a student apprentice in what had recently evolved as an unprecedented Naval medical research and development initiative with SEAP.

The previous summer, the Office of Research Administration (ORA) at the Naval Medical Research Center founded the first national SEAP curriculum in research administration and research ethics. Andy Young became one of the first participants in that program and continued in the ORA-NMRC curriculum during the next 4 years. Those 4 years became a prelude to something he never dreamed would happen. During the years of his apprenticeship, Andy Young caught the fever we know as "Navy Medicine." Today, after graduating Brown University in pre-med and computer science, Andy has decided to realize his dream of becoming a physician and a naval officer. How did a choice like this evolve from a simple high school experience?

Andy tells it in his own words:

"When I was a senior in high school, I knew that I wanted to go out into the world and do good for other people. I never wanted just to have 'a job.' I wanted something more. Like most other seniors, I did not have a very solid idea how to accomplish that goal. I knew I wanted to go to college, but, at the time, college was mysterious and did not have any real concrete assurances for my dreams.

While most people will tell any high school student that they never figured out right away what they wanted to do with their life, you do not actually believe them. To a young high school student, adults seem to have all the answers to all the questions that we have but are often afraid to admit they don't. It seems as though everyone is starting earlier and working harder than ever before to become powerful and wealthy. Somehow, there is something inside you that sees past all that and realizes that there just has to be something more to life . . . something worthier . . . something that happens only when you help others in need.

While high school and college provide you with all the necessary tools to become successful in the world, they need to be complemented by real world experiences. There needs to be some forum that gives a student a connection between the real world and life in academia. This is where an internship plays a major role.

The idea of an internship is to bridge the gap between the two worlds in a safe and uncompromising way. It gives a student a chance to work closely with a mentor so that academic knowledge and human experience can fertilize each other. When I took the SEAP scholarship, I did not think it would be much different from any high school 'job.' Little did I know! Now that I look back, there were telltale signs that could have prepared me better for what was in store for me. In the end, I was challenged to expand

Photos courtesy of Dr. Gabriele

Dr. Gabriele and Andrew Young.

my mind and to allow my dreams to come closer to reality than I thought possible.

Today, I have more to look forward to than I thought I would after college. Currently, I am in the process of applying to medical school, hopefully with the aid of the Health Professions Scholarship Program to become a Navy physician. Because of the ORA-NMRC SEAP program, I have redefined what I want to do with my life. I did not change my mind about doing good for others as I mentioned before; rather, I have changed how I am being drawn to go about it. You might say that my 4 years observing and stepping into the world of Navy medicine gave me a chance to see how some of my dreams could get closer to reality.

The GWU-SEAP program at ORA-NMRC showed me what medicine had to offer, and it was the critical seed for my increasingly more intense experiences during college. Because of my Navy medical research and development experience through the ORA-SEAP program, I decided to volunteer as an emergency medical technician while in college. This further spurred my interest back at NMRC in combat casualty medicine and potentially a career in Navy surgical service in battlefield operations. In addition, I came to understand how knowledge/information technologies are critical for healthcare in Navy operational medicine. And from participation in ORA-NMRC research ethics programs, I came to see how the largest questions of human living meet up with the medical needs of those who are wounded and ill.

In short, 4 years with naval medical research through the ORA-SEAP program have taught me better how to hear the voices of those who suffer. And from that experience, I hope as a Navy physician to stand closer to those voices here and overseas in peacetime and during conflict."

Good story. Good example of what is possible when Navy medicine service reaches the young. There's a line from an old movie that seems to capture something of the lesson we can learn from Andy Young's story: "The more we are looked to for example, the better examples we become." In Andy's case, what started out as a high school opportunity gave birth to more than just an idea about a future job. The child of experience became parent to something much bigger. Perhaps that makes us in Navy medicine also something "much bigger." Partnerships like the ORA-SEAP Program can make us "big-souled;" or, as it is said in another language: "magnanimous." Healing the sick and raising up the wounded are nothing less.

Sounds like a decent idea to get others to be just as large and just as "magnanimous" to continue the pace Navy medicine sets to enrich our quality of life and the American "public trust." ❑

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Book Review

Combat Surgeon: On Iwo Jima with the 27th Marines by James S. Vedder. Presidio Press, Novato, CA. 226 pages, 1984.

It is a great sight to see that bloody island fading from view." These were the words of Dr. James Vedder, from the deck of *Sea Sturgeon* on 27 March 1945, as he and COL Robertson, commander of the 3rd Battalion 27th Marines, watched Iwo Jima disappear. An operation that was supposed to be over in 4 days—the taking of Iwo Jima—proved a much more grueling ordeal, lasting more than a month. Dr. Vedder, chief medical officer of the 3rd Battalion 27th Marines, spent that month treating patients, maintaining order, boosting the morale of his corpsmen, and fighting for his own survival.

Dr. Vedder's memoir is a testament to the dedication and courage of Navy medical personnel. Although his aid station was not technically on the front line of fighting, Iwo Jima, a very small island where the Japanese had dug in underground, offered no real safety. Dr. Vedder was nearly killed by a Japanese soldier playing dead under an American poncho, and later was the target of a sniper. His men were also in constant danger. His corpsmen took turns on the front lines and many lost their lives. PhM1c John Willis threw eight enemy grenades out of the foxhole in which he was treating wounded Marines before being killed by the ninth. For his valor and dedication to his patients, Willis received a posthumous Medal of Honor.

As one reads this book, it is often difficult to remember that it is a memoir and not a novel. Vedder's writing flows smoothly and is easy to read. He gives excellent descriptions of the 3rd Battalion's movements, specifically the operating locations of his ever moving aid station. "The revetment possessed a flat area the size of a regulation basketball court. Three sides enclosed the space with steeply sloping, sandy banks rising fourteen to eighteen feet. The western end of the enclosure was wide open…." However skillful Vedder is in describing the Iwo Jima he saw up close, the photographs he has included are fantastic aids in understanding this month in his life. These images really drive home the primitive nature of the aid station. Imagine sometimes treating critical patients in foxholes with shells exploding all around!

As a physician, Dr. Vedder spent most of his days surrounded by corpsmen and litter bearers. His writing shows the great respect and appreciation he had for these men. Most of them were very young; the average litter bearer was only 18. Although Vedder expected a great deal from them, he dealt with them compassionately, understanding why some were reluctant to go to the front lines.

Vedder's memoir is also revealing in another sense. Although he shared foxholes with his enlisted corpsmen, he was an officer, and as such, was privy to tactical plans. Dr. Vedder offers some explanation of various command decisions and tactics which otherwise would seem foolhardy or illogical. However, having seen the human toll taken, he does not praise all decisions. A corpsman would not have the ability to see the engagement at Iwo Jima from Vedder's officer's perspective.

Combat Surgeon: On Iwo Jima with the 27th Marines is a descriptive book, quite emotionally charged and hard to put down.

—Ms. Tronic is a summer intern for M09H, Bureau of Medicine and Surgery, Washington, DC, and a graduate student at Simmons College, Boston, MA.

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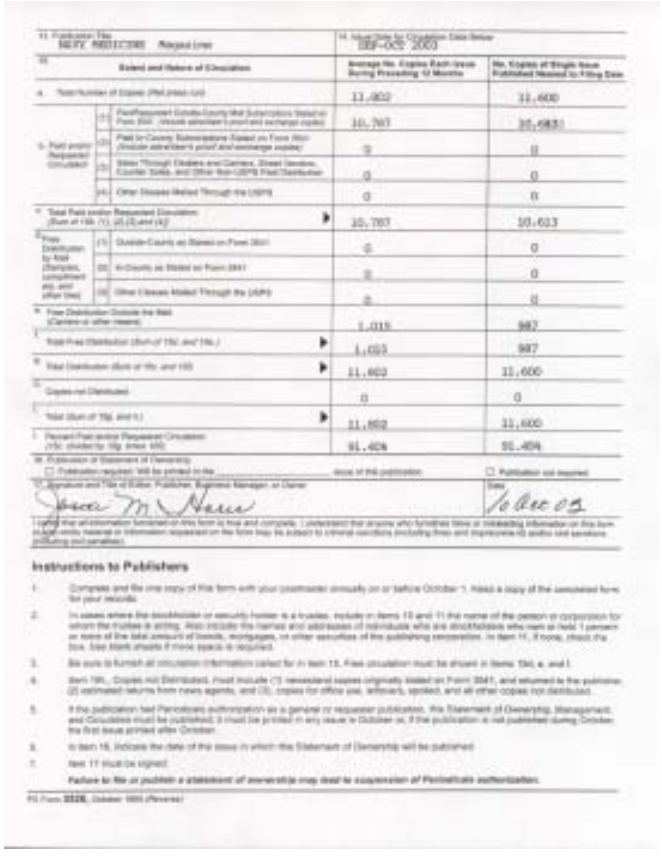

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